

Cyclic Aliphatic Bromides Cluster (HBCD)
(CASRN: 25637-99-4; 3194-55-6; 3194-57-8)

**Systematic Review Supplemental File for the TSCA Risk
Evaluation: Data Quality Evaluation of Ecological Hazard Studies**

For references containin information on multiple test organisms, durations, and/or effects in the TSCA Risk Evaluation of Hexabromocyclodo-decane, multiple data quality evaluation tables are provided *only if* the metrics were evaluated differently. Some papers that underwent evaluatoin but fell off-topic later on are not summarized in the data evaluation tables. Refer to Appendix F of ‘*Application of Systematic Review in TSCA Risk Evaluations*’ at <https://www.epa.gov> for more information of evaluation procedures and parameters.

Table 1: Data Evaluation table for reference 938764 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/938764).

Study Citation:	Schriks, M.,Zvinavashe, E.,Furlow, J. D.,Murk, A. J.. 2006. Disruption of thyroid hormone-mediated <i>Xenopus laevis</i> tadpole tail tip regression by hexabromocyclododecane (HBCD) and 2,2',3,3',4,4',5,5',6-nona brominated diphenyl ether (BDE206). Chemosphere 65:1904-1908					
Data Type:	Other; Aquatic; other tadpole tail tip					
Hero ID:	938764					
Domain		Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance						
	Metric 1:	Test Substance Identity	Low	× 2	6	Hexabromocyclododecane (HBCD technical mixture was used, with no additional information on percentages of various components or if the test substance was further analyzed.
	Metric 2:	Test Substance Source	Medium	× 1	2	Only mentioned the source (BSEF), without any other information about the batch, or product type.
	Metric 3:	Test Substance Purity	Low	× 1	3	purity not supplied by provider
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	× 2	2	See note '***' at the bottom of the table.
	Metric 5:	Negative Control Response	High	× 1	1	See note '***' at the bottom of the table.
	Metric 6:	Randomized Allocation	Low	× 1	3	How the tips were allocated to exposure groups was not explained.
Domain 3: Exposure Characterization						
	Metric 7:	Experimental System/Test Media Preparation	Medium	× 2	4	Exposures were statically renewed every other day, and took place in 26-well plates. DMSO was used as the solvent control.
	Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note '***' at the bottom of the table.
	Metric 9:	Measurement of Test Substance Concentration	Medium	× 1	2	Exposure concentrations were not measured (only nominal amounts provided), however it is likely actual concentrations are similar to nominal concentrations.
	Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note '***' at the bottom of the table.
	Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note '***' at the bottom of the table.
	Metric 12:	Testing at or Below Solubility Limit	High	× 1	1	See note '***' at the bottom of the table.
Domain 4: Test Organism						
	Metric 13:	Test Organism Characteristics	High	× 2	2	See note '***' at the bottom of the table.
	Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note '***' at the bottom of the table.
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Study Citation:	Schriks, M.,Zvinavashe, E.,Furlow, J. D.,Murk, A. J.. 2006. Disruption of thyroid hormone-mediated Xenopus laevis tadpole tail tip regression by hexabromocyclododecane (HBCD) and 2,2',3,3',4,4',5,5',6-nona brominated diphenyl ether (BDE206). Chemosphere 65:1904-1908					
Data Type:	Other; Aquatic; other tadpole tail tip					
Hero ID:	938764					
Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}	
	Metric 15: Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.	
	Metric 16: Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 5: Outcome Assessment						
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
	Metric 22: Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.4		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lceil \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rceil_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High= ≥ 1 to < 1.7 ; Medium= ≥ 1.7 to < 2.4 ; Low= ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 2: Data Evaluation table for reference 1062065 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1062065).

Study Citation:	Thienpont, B.,Tingaud-Sequeira, A.,Prats, E.,Barata, C.,Babin, P. J.,Raldúa, D.. 2011. Zebrafish eleutheroembryos provide a suitable vertebrate model for screening chemicals that impair thyroid hormone synthesis. Environmental Science and Technology 45:7525-7532					
Data Type:	Acute (0-96 hour); Aquatic; Fish					
Hero ID:	1062065					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	Medium	× 1	2	Source was reported (Sigma), but no other details on composition (or it's verification specs) or batch number was reported. The CASRN was included in the SI.	
Metric 3:	Test Substance Purity	Low	× 1	3	No information provided on test substance purity.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	stock solutions were prepared in DMSO; vehicle control embryos exposed to 0.1 percent DMSO.	
Metric 5:	Negative Control Response	Unacceptable		4	The biological responses of negative control groups were not reported	
Metric 6:	Randomized Allocation	Low	× 1	3	There was no report on how organisms were allocated to study groups.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	Medium	× 1	2	Nominal concentrations reported.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	Low	× 1	3	Exposures were based on MATCs, as explained in SI, but only one concentration was used . The purpose of the study wasn't to look at a dose response resulting from HBCD exposures.	
Metric 12:	Testing at or Below Solubility Limit	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	Low	× 1	3	No report of acclimatization or pre-treatment conditions	
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Study Citation:	Thienpont, B.,Tingaud-Sequeira, A.,Prats, E.,Barata, C.,Babin, P. J.,Raldúa, D.. 2011. Zebrafish eleutheroembryos provide a suitable vertebrate model for screening chemicals that impair thyroid hormone synthesis. Environmental Science and Technology 45:7525-7532					
Data Type:	Acute (0-96 hour); Aquatic; Fish					
Hero ID:	1062065					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
	Metric 15: Number of Organisms and Replicates per Group	Medium	× 1	2	A minimum of eighteen eleutheroembryos were exposed. Unsure of sample size for HBCD.	
	Metric 16: Adequacy of Test Conditions	Low	× 1	3	no information on experimental housing conditions.	
Domain 5: Outcome Assessment						
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note ‘***’ at the bottom of the table.	
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ‘***’ at the bottom of the table.	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ‘***’ at the bottom of the table.	
	Metric 20: Outcomes Unrelated to Exposure	Medium	× 1	2	Not reported.	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	High	× 1	1	See note ‘***’ at the bottom of the table.	
	Metric 22: Reporting of Data	High	× 2	2	See note ‘***’ at the bottom of the table.	
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ‘***’ at the bottom of the table.	
Overall Quality Determination [‡]		Unacceptable → Low		4.0		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases}$$

where High= ≥ 1 to < 1.7 ; Medium= ≥ 1.7 to < 2.4 ; Low= ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 3: Data Evaluation table for reference 1274149 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1274149).

Study Citation:	Anselmo, H. M. R.,Koerting, L.,Devito, S.,van den Berg, J. H. J.,Dubbeldam, M.,Kwadijk, C.,Murk, A. J.. 2011. Early life developmental effects of marine persistent organic pollutants on the sea urchin Psammechinus miliaris. Ecotoxicology and Environmental Safety 74:2182-2192				
Data Type:	Other; Aquatic; Invertebrates				
Hero ID:	1274149				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance					
Metric 1:	Test Substance Identity	Low	× 2	6	No CASRN or purity mentioned. Only cited that it is a technical mixture.
Metric 2:	Test Substance Source	Low	× 1	3	A gift from a professor. However, other chemicals in the study cited the source.
Metric 3:	Test Substance Purity	Low	× 1	3	No purity mentioned. Validation of the test substance is needed.
Domain 2: Test Design					
Metric 4:	Negative Controls	High	× 2	2	See note ^(***) at the bottom of the table.
Metric 5:	Negative Control Response	High	× 1	1	See note ^(***) at the bottom of the table.
Metric 6:	Randomized Allocation	High	× 1	1	See note ^(***) at the bottom of the table.
Domain 3: Exposure Characterization					
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^(***) at the bottom of the table.
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^(***) at the bottom of the table.
Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ^(***) at the bottom of the table.
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^(***) at the bottom of the table.
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^(***) at the bottom of the table.
Metric 12:	Testing at or Below Solubility Limit	High	× 1	1	See note ^(***) at the bottom of the table.
Domain 4: Test Organism					
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^(***) at the bottom of the table.
Metric 14:	Acclimatization and Pretreatment Conditions	High	× 1	1	See note ^(***) at the bottom of the table.
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^(***) at the bottom of the table.
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^(***) at the bottom of the table.
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Study Citation:	Anselmo, H. M. R.,Koerting, L.,Devito, S.,van den Berg, J. H. J.,Dubbeldam, M.,Kwadijk, C.,Murk, A. J.. 2011. Early life developmental effects of marine persistent organic pollutants on the sea urchin Psammechinus miliaris. Ecotoxicology and Environmental Safety 74:2182-2192				
Data Type:	Other; Aquatic; Invertebrates				
Hero ID:	1274149				
Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}
Domain 5: Outcome Assessment					
Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.
Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 6: Confounding / Variable Control					
Metric 19:	Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.
Metric 20:	Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 7: Data Presentation and Analysis					
Metric 21:	Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.
Metric 22:	Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.
Metric 23:	Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.
Overall Quality Determination [‡]		High		1.3	
Extracted		Yes			

* MWF = Metric Weighting Factor

† High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

‡ The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High= ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

†† Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{***} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 4: Data Evaluation table for reference 1401837 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1401837).

Study Citation:	Fernie, K. J.,Martinson, S. C.,Bird, D. M.,Ritchie, I. J.,Letcher, R. J.. 2011. Reproductive changes in American kestrels (<i>Falco sparverius</i>) in relation to exposure to technical hexabromocyclododecane flame retardant. Environmental Toxicology and Chemistry 30:2570-2575					
Data Type:	Chronic (>21 days); Terrestrial; Birds					
Hero ID:	1401837					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ‘***’ at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ‘***’ at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	See note ‘***’ at the bottom of the table.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ‘***’ at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note ‘***’ at the bottom of the table.	
Metric 6:	Randomized Allocation	High	× 1	1	See note ‘***’ at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	Medium	× 2	4	Modified feeding diet and only one dose concentration. However, this concentration was established in a previous study.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ‘***’ at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ‘***’ at the bottom of the table.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ‘***’ at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	Medium	× 1	2	Number of paired birds were not stated in this paper but the methods were referenced in a previous study.	
Metric 12:	Testing at or Below Solubility Limit	Medium	× 1	2	Source states that the level of HBCD exposure was slightly higher than the environmental concentrations.	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	Medium	× 2	4	Study used a different species that is normally recommended for this type of study.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ‘***’ at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ‘***’ at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ‘***’ at the bottom of the table.	
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Study Citation:	Fernie, K. J.,Marteinson, S. C.,Bird, D. M.,Ritchie, I. J.,Letcher, R. J.. 2011. Reproductive changes in American kestrels (<i>Falco sparverius</i>) in relation to exposure to technical hexabromocyclododecane flame retardant. Environmental Toxicology and Chemistry 30:2570-2575					
Data Type:	Chronic (>21 days); Terrestrial; Birds					
Hero ID:	1401837					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 5: Outcome Assessment						
Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 6: Confounding / Variable Control						
Metric 19:	Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 20:	Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
Metric 21:	Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 22:	Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 23:	Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.2		
Extracted		Yes				

* MWF = Metric Weighting Factor

† High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

‡ The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lceil \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rceil_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High= ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

†† Reviewers document uncertainties and strengths for each metric, when deemed necessary.

*** Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 5: Data Evaluation table for reference 1403364 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1403364).

Study Citation:	Palace, V.,Park, B.,Pleskach, K.,Gemmill, B.,Tomy, G.. 2010. Altered thyroxine metabolism in rainbow trout (<i>Oncorhynchus mykiss</i>) exposed to hexabromocyclododecane (HBCD). Chemosphere 80:165-169				
Data Type:	Chronic (>21 days); Aquatic; Fish				
Hero ID:	1403364				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance					
Metric 1:	Test Substance Identity	High	× 2	2	See note ‘***’ at the bottom of the table.
Metric 2:	Test Substance Source	Low	× 1	3	The HBCD isomer source was not provided.
Metric 3:	Test Substance Purity	Low	× 1	3	Very little information is provided by the authors on the HBCD used in these experiments; purity not provided.
Domain 2: Test Design					
Metric 4:	Negative Controls	High	× 2	2	See note ‘***’ at the bottom of the table.
Metric 5:	Negative Control Response	High	× 1	1	See note ‘***’ at the bottom of the table.
Metric 6:	Randomized Allocation	High	× 1	1	See note ‘***’ at the bottom of the table.
Domain 3: Exposure Characterization					
Metric 7:	Experimental System/Test Media Preparation	Low	× 2	6	Experimental conditions were not explained as fully as the acclimatization period and it isn’t clear whether the experiments were run via static or flow-through conditions, and if leftover food was removed from the tanks after the feedings.
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ‘***’ at the bottom of the table.
Metric 9:	Measurement of Test Substance Concentration	Medium	× 1	2	Only nominal concentrations for oral exposure provided.
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ‘***’ at the bottom of the table.
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ‘***’ at the bottom of the table.
Metric 12:	Testing at or Below Solubility Limit	N/A		N/A	HBCD was mixed in with the pellet food.
Domain 4: Test Organism					
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ‘***’ at the bottom of the table.
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ‘***’ at the bottom of the table.
Metric 15:	Number of Organisms and Replicates per Group	Medium	× 1	2	No true replicates were used. Twenty fish per exposure treatment (one rep per exposure group) were used.
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Study Citation:	Palace, V.,Park, B.,Pleskach, K.,Gemmill, B.,Tomy, G.. 2010. Altered thyroxine metabolism in rainbow trout (<i>Oncorhynchus mykiss</i>) exposed to hexabromocyclododecane (HBCD). Chemosphere 80:165-169					
Data Type:	Chronic (>21 days); Aquatic; Fish					
Hero ID:	1403364					
Domain	Metric		Rating [†]	MWF*	Score	Comments ^{††}
	Metric 16:	Adequacy of Test Conditions	Medium	× 1	2	No details on water conditions, temperature, etc. of the experiment. The main details in the methods specifically addressed the feed preparations and dosing.
Domain 5: Outcome Assessment						
	Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 6: Confounding / Variable Control						
	Metric 19:	Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 20:	Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 7: Data Presentation and Analysis						
	Metric 21:	Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 22:	Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 23:	Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.
Overall Quality Determination [‡]			High		1.4	
Extracted			Yes			

* MWF = Metric Weighting Factor

† High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

‡ The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

†† Reviewers document uncertainties and strengths for each metric, when deemed necessary.

*** Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 6: Data Evaluation table for reference 1403482 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1403482).

Study Citation:	Crump, D.,Egloff, C.,Chiu, S.,Letcher, R. J.,Chu, S.,Kennedy, S. W.. 2010. Pipping success, isomer-specific accumulation, and hepatic mRNA expression in chicken embryos exposed to HBCD. Toxicological Sciences 115:492-500					
Data Type:	Chronic (>21 days); Terrestrial; Birds					
Hero ID:	1403482					
Domain		Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance						
	Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 3: Exposure Characterization						
	Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 12:	Testing at or Below Solubility Limit	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 4: Test Organism						
	Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 5: Outcome Assessment						
	Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.
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Study Citation:	Crump, D.,Egloff, C.,Chiu, S.,Letcher, R. J.,Chu, S.,Kennedy, S. W.. 2010. Pipping success, isomer-specific accumulation, and hepatic mRNA expression in chicken embryos exposed to HBCD. Toxicological Sciences 115:492-500					
Data Type:	Chronic (>21 days); Terrestrial; Birds					
Hero ID:	1403482					
Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}	
Domain 6: Confounding / Variable Control						
Metric 19:	Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 20:	Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
Metric 21:	Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 22:	Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 23:	Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.0		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High= ≥ 1 to < 1.7 ; Medium= ≥ 1.7 to < 2.4 ; Low= ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{***} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 7: Data Evaluation table for reference 1408111 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1408111).

Study Citation:	Crump, D.,Chiu, S.,Egloff, C.,Kennedy, S. W.. 2008. Effects of hexabromocyclododecane and polybrominated diphenyl ethers on mRNA expression in chicken (Gallus domesticus) hepatocytes. Toxicological Sciences 106:479-487					
Data Type:	Acute (0-96 hour); Terrestrial; Birds					
Hero ID:	1408111					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note '***' at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note '***' at the bottom of the table.	
Metric 3:	Test Substance Purity	Low	× 1	3	The purity was not reported.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note '***' at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note '***' at the bottom of the table.	
Metric 6:	Randomized Allocation	Medium	× 1	2	It wasn't reported whether cells were randomly collected from chicken embryos, and distributed into exposure treatments.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note '***' at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note '***' at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	Medium	× 1	2	Nominal concentrations were reported.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note '***' at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note '***' at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	High	× 1	1	See note '***' at the bottom of the table.	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note '***' at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note '***' at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note '***' at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note '***' at the bottom of the table.	
Domain 5: Outcome Assessment						
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Study Citation:	Crump, D.,Chiu, S.,Egloff, C.,Kennedy, S. W.. 2008. Effects of hexabromocyclododecane and polybrominated diphenyl ethers on mRNA expression in chicken (Gallus domesticus) hepatocytes. Toxicological Sciences 106:479-487					
Data Type:	Acute (0-96 hour); Terrestrial; Birds					
Hero ID:	1408111					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note '***' at the bottom of the table.	
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note '***' at the bottom of the table.	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note '***' at the bottom of the table.	
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note '***' at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	High	× 1	1	See note '***' at the bottom of the table.	
	Metric 22: Reporting of Data	High	× 2	2	See note '***' at the bottom of the table.	
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note '***' at the bottom of the table.	
Overall Quality Determination [‡]		High		1.2		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High= ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

****** Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. **(a)** High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. **(b)** Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. **(c)** Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. **(d)** Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. **(e)** Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 8: Data Evaluation table for reference 1409610 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1409610).

Study Citation:	Palace, V. P.,Pleskach, K.,Halldorson, T.,Danell, R.,Wautier, K.,Evans, B.,Alaee, M.,Marvin, C.,Tomy, G. T.. 2008. Biotransformation enzymes and thyroid axis disruption in juvenile rainbow trout (Oncorhynchus mykiss) exposed to hexabromocyclododecane diastereoisomers. Environmental Science and Technology 42:1967-1972					
Data Type:	Chronic (>21 days); Aquatic; Fish					
Hero ID:	1409610					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note '***' at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note '***' at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	See note '***' at the bottom of the table.	
Domain 2: Test Design						
Metric 4:	Negative Controls	Medium	× 2	4	Authors reported having a reference diet, but specific methods were only referenced from another publication;.	
Metric 5:	Negative Control Response	High	× 1	1	See note '***' at the bottom of the table.	
Metric 6:	Randomized Allocation	Low	× 1	3	There was no report on how organisms were allocated to study groups.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note '***' at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note '***' at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note '***' at the bottom of the table.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note '***' at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note '***' at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	N/A		N/A	diet-exposure	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note '***' at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	Medium	× 1	2	Fish were acclimatized for 7 days prior to the start of the experiment. No further details reported on acclimatization.	
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Study Citation:	Palace, V. P.,Pleskach, K.,Halldorson, T.,Danell, R.,Wautier, K.,Evans, B.,Alae, M.,Marvin, C.,Tomy, G. T.. 2008. Biotransformation enzymes and thyroid axis disruption in juvenile rainbow trout (Oncorhynchus mykiss) exposed to hexabromocyclododecane diastereoisomers. Environmental Science and Technology 42:1967-1972					
Data Type:	Chronic (>21 days); Aquatic; Fish					
Hero ID:	1409610					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
	Metric 15: Number of Organisms and Replicates per Group	Medium	× 1	2	Only one true replicate or tank per treatment. Four fish from each tank were sacrificed on days 0, 7, 14, and 56 of the uptake phase and days 7, 14, 56, and 112 of the depuration phase.	
	Metric 16: Adequacy of Test Conditions	High	× 1	1	See note ‘***’ at the bottom of the table.	
Domain 5: Outcome Assessment						
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note ‘***’ at the bottom of the table.	
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ‘***’ at the bottom of the table.	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ‘***’ at the bottom of the table.	
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note ‘***’ at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	Medium	× 1	2	Statistic methods were referred to, but not adequately described.	
	Metric 22: Reporting of Data	High	× 2	2	See note ‘***’ at the bottom of the table.	
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ‘***’ at the bottom of the table.	
Overall Quality Determination [‡]		High		1.2		
Extracted		Yes				
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Study Citation:	Palace, V. P.,Pleskach, K.,Halldorson, T.,Danell, R.,Wautier, K.,Evans, B.,Alaee, M.,Marvin, C.,Tomy, G. T.. 2008. Biotransformation enzymes and thyroid axis disruption in juvenile rainbow trout (Oncorhynchus mykiss) exposed to hexabromocyclododecane diastereoisomers. Environmental Science and Technology 42:1967-1972
Data Type:	Chronic (>21 days); Aquatic; Fish
Hero ID:	1409610

Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
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* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases}$$

where High= ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{***} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. **(a)** High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. **(b)** Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. **(c)** Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. **(d)** Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. **(e)** Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 9: Data Evaluation table for reference 1412194 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1412194).

Study Citation:	Aniagu, S. O.,Williams, T. D.,Allen, Y.,Katsiadaki, I.,Chipman, J. K.. 2008. Global genomic methylation levels in the liver and gonads of the three-spine stickleback (<i>Gasterosteus aculeatus</i>) after exposure to hexabromocyclododecane and 17-beta oestradiol. Environment International 34:310-317					
Data Type:	Chronic (>21 days); Aquatic; Fish					
Hero ID:	1412194					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	Low	× 2	6	No information provided about the toxicant.	
Metric 2:	Test Substance Source	Low	× 1	3	no source mentioned	
Metric 3:	Test Substance Purity	Low	× 1	3	source not mentioned, no information on chemical purity	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 5:	Negative Control Response	Unacceptable		4	Biological responses of the negative control groups (s) or treatment groups were not reported.	
Metric 6:	Randomized Allocation	Low	× 1	3	There was no report on how organisms were allocated to study groups.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	Medium	× 1	2	Only nominal concentrations were reported, but flow through system may have kept the exposure concentrations consistent throughout the exposure period.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	Two exposure treatments represented either an environmentally-relevant concentration, or a higher concentration (magnitude higher). Solvent controls for both HBCD treatment groups were also used (two different concentrations of acetone). Although only two concentrations were used, these were justified by the author.	
Metric 12:	Testing at or Below Solubility Limit	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	Medium	× 2	4	No information besides female fish being used for HBCD exposures (e.g., age, size).	
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Study Citation:	Aniagu, S. O.,Williams, T. D.,Allen, Y.,Katsiadaki, I.,Chipman, J. K.. 2008. Global genomic methylation levels in the liver and gonads of the three-spine stickleback (<i>Gasterosteus aculeatus</i>) after exposure to hexabromocyclododecane and 17-beta oestradiol. Environment International 34:310-317					
Data Type:	Chronic (>21 days); Aquatic; Fish					
Hero ID:	1412194					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
	Metric 14: Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
	Metric 15: Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.	
	Metric 16: Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 5: Outcome Assessment						
	Metric 17: Outcome Assessment Methodology	Medium	× 2	4	It wasn't explained why HBCD treatment only used female stickleback livers.	
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 20: Outcomes Unrelated to Exposure	Medium	× 1	2	Health outcomes unrelated to exposure were not reported.	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
	Metric 22: Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		Unacceptable → Low		4.0		
Extracted		No				
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Study Citation:	Aniagu, S. O.,Williams, T. D.,Allen, Y.,Katsiadaki, I.,Chipman, J. K.. 2008. Global genomic methylation levels in the liver and gonads of the three-spine stickleback (<i>Gasterosteus aculeatus</i>) after exposure to hexabromocyclododecane and 17-beta oestradiol. Environment International 34:310-317
Data Type:	Chronic (>21 days); Aquatic; Fish
Hero ID:	1412194

Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}
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* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases}$$

where High= ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 10: Data Evaluation table for reference 1412802 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1412802).

Study Citation:	Kuiper, R. V., Cantón, R. F., Leonards, P. E., Jenssen, B. M., Dubbeldam, M., Wester, P. W., van den Berg, M., Vos, J. G., Vethaak, A. D.. 2007. Long-term exposure of European flounder (<i>Platichthys flesus</i>) to the flame-retardants tetrabromobisphenol A (TBBPA) and hexabromocyclododecane (HBCD). <i>Ecotoxicology and Environmental Safety</i> 67:349-360				
Data Type:	Chronic (>21 days); Aquatic; Fish				
Hero ID:	1412802				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance					
Metric 1:	Test Substance Identity	High	× 2	2	See note *** at the bottom of the table.
Metric 2:	Test Substance Source	High	× 1	1	See note *** at the bottom of the table.
Metric 3:	Test Substance Purity	High	× 1	1	See note *** at the bottom of the table.
Domain 2: Test Design					
Metric 4:	Negative Controls	High	× 2	2	See note *** at the bottom of the table.
Metric 5:	Negative Control Response	High	× 1	1	See note *** at the bottom of the table.
Metric 6:	Randomized Allocation	Low	× 1	3	There was no report on how organisms were allocated to study groups.
Domain 3: Exposure Characterization					
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note *** at the bottom of the table.
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note *** at the bottom of the table.
Metric 9:	Measurement of Test Substance Concentration	Low	× 1	3	Test substance was not measured in the exposure medium.
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note *** at the bottom of the table.
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	.
Metric 12:	Testing at or Below Solubility Limit	N/A		N/A	Exposure was through spiked sediment and food.
Domain 4: Test Organism					
Metric 13:	Test Organism Characteristics	High	× 2	2	See note *** at the bottom of the table.
Metric 14:	Acclimitization and Pretreatment Conditions	Low	× 1	3	It was not mentioned if the flounder were acclimated to the experiment conditions.
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note *** at the bottom of the table.
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note *** at the bottom of the table.
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Study Citation:	Kuiper, R. V.,Cantón, R. F.,Leonards, P. E.,Jenssen, B. M.,Dubbeldam, M.,Wester, P. W.,van den Berg, M.,Vos, J. G.,Vethaak, A. D.. 2007. Long-term exposure of European flounder (Platichthys flesus) to the flame-retardants tetrabromobisphenol A (TBBPA) and hexabromocyclododecane (HBCD). Ecotoxicology and Environmental Safety 67:349-360					
Data Type:	Chronic (>21 days); Aquatic; Fish					
Hero ID:	1412802					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 5: Outcome Assessment						
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
	Metric 22: Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.3		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{***} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 11: Data Evaluation table for reference 1443861 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1443861).

Study Citation:	Law, K.,Palace, V. P.,Halldorson, T.,Danell, R.,Wautier, K.,Evans, B.,Alaee, M.,Marvin, C.,Tomy, G. T.. 2006. Dietary accumulation of hexabromocyclododecane diastereoisomers in juvenile rainbow trout (Oncorhynchus mykiss). I: Bioaccumulation parameters and evidence of bioisomerization. Environmental Toxicology and Chemistry 25					
Data Type:	Chronic (>21 days); Aquatic; Fish					
Hero ID:	1443861					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 5:	Negative Control Response	Unacceptable		4	not reported	
Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	N/A		N/A	Diet exposure	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	Medium	× 2	4	Besides fish weight, there is no indication of source, age, gender, or other characteristics of the test organisms.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	N/A		N/A	Purpose of study wasn't to get a dose response; only one exposure tank per isomer.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
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Study Citation:	Law, K.,Palace, V. P.,Halldorson, T.,Danell, R.,Wautier, K.,Evans, B.,Alaee, M.,Marvin, C.,Tomy, G. T.. 2006. Dietary accumulation of hexabromocyclododecane diastereoisomers in juvenile rainbow trout (Oncorhynchus mykiss). I: Bioaccumulation parameters and evidence of bioisomerization. Environmental Toxicology and Chemistry 25				
Data Type:	Chronic (>21 days); Aquatic; Fish				
Hero ID:	1443861				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 5: Outcome Assessment					
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 6: Confounding / Variable Control					
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 20: Outcomes Unrelated to Exposure	Medium	× 1	2	none reported
Domain 7: Data Presentation and Analysis					
	Metric 21: Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 22: Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.
Overall Quality Determination [†]		Unacceptable → Low		4.0	
Extracted		No			

* MWF = Metric Weighting Factor

† High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

‡ The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

†† Reviewers document uncertainties and strengths for each metric, when deemed necessary.

*** Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 12: Data Evaluation table for reference 1927533 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1927533).

Study Citation:	Wu, M.,Zuo, Z.,Li, B.,Huang, L.,Chen, M.,Wang, C.. 2013. Effects of low-level hexabromocyclododecane (HBCD) exposure on cardiac development in zebrafish embryos. Ecotoxicology 22:1200-1207					
Data Type:	Acute (0-96 hour); Aquatic; Fish					
Hero ID:	1927533					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 6:	Randomized Allocation	Low	× 1	3	Embryo treatment allocation was not reported.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	Medium	× 1	2	Nominal concentrations used, but 2 water changes per day alleviates some concern.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	Medium	× 1	2	Some exposure concentrations above water solubility.	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 5: Outcome Assessment						
Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.	
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Study Citation:	Wu, M.,Zuo, Z.,Li, B.,Huang, L.,Chen, M.,Wang, C.. 2013. Effects of low-level hexabromocyclododecane (HBCD) exposure on cardiac development in zebrafish embryos. Ecotoxicology 22:1200-1207					
Data Type:	Acute (0-96 hour); Aquatic; Fish					
Hero ID:	1927533					
Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}	
Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 6: Confounding / Variable Control						
Metric 19:	Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 20:	Outcomes Unrelated to Exposure	Medium	× 1	2	No differences in organism health reported.	
Domain 7: Data Presentation and Analysis						
Metric 21:	Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 22:	Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 23:	Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.2		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases}$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 13: Data Evaluation table for reference 1927579 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1927579).

Study Citation:	Du, M.,Lin, L.,Yan, C.,Zhang, X.. 2012. Diastereoisomer- and enantiomer-specific accumulation, depuration, and bioisomerization of hexabromocyclododecanes in zebrafish (Danio rerio). Environmental Science and Technology 46:11040-11046					
Data Type:	Chronic (>21 days); Aquatic; Fish					
Hero ID:	1927579					
Domain		Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance						
	Metric 1:	Test Substance Identity	High	× 2	2	See note '***' at the bottom of the table.
	Metric 2:	Test Substance Source	High	× 1	1	See note '***' at the bottom of the table.
	Metric 3:	Test Substance Purity	Low	× 1	3	Percent purity not provided.
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	× 2	2	See note '***' at the bottom of the table.
	Metric 5:	Negative Control Response	High	× 1	1	See note '***' at the bottom of the table.
	Metric 6:	Randomized Allocation	Low	× 1	3	Uncertain of whether organisms were randomly allocated to treatment groups.
Domain 3: Exposure Characterization						
	Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note '***' at the bottom of the table.
	Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note '***' at the bottom of the table.
	Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note '***' at the bottom of the table.
	Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note '***' at the bottom of the table.
	Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note '***' at the bottom of the table.
	Metric 12:	Testing at or Below Solubility Limit	N/A		N/A	food exposure; amount of HBCD in control food was ND.
Domain 4: Test Organism						
	Metric 13:	Test Organism Characteristics	High	× 2	2	See note '***' at the bottom of the table.
	Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note '***' at the bottom of the table.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	× 1	2	There was only one tank per exposure. No true replicates to characterize toxicological effects, but this wasn't the study goal (uptake/depuration study).
	Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note '***' at the bottom of the table.
Domain 5: Outcome Assessment						
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Study Citation:	Du, M.,Lin, L.,Yan, C.,Zhang, X.. 2012. Diastereoisomer- and enantiomer-specific accumulation, depuration, and bioisomerization of hexabromocyclododecanes in zebrafish (Danio rerio). Environmental Science and Technology 46:11040-11046					
Data Type:	Chronic (>21 days); Aquatic; Fish					
Hero ID:	1927579					
Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}	
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 20: Outcomes Unrelated to Exposure	Medium	× 1	2	No health outcomes reported.	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
	Metric 22: Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.2		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases}$$

where High= ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

****** Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. **(a)** High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. **(b)** Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. **(c)** Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. **(d)** Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. **(e)** Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 14: Data Evaluation table for reference 1927583 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1927583).

Study Citation:	Wu, T.,Wang, S.,Huang, H.,Zhang, S.. 2012. Diastereomer-Specific Uptake, Translocation, and Toxicity of Hexabromocyclododecane Diastereoisomers to Maize. Journal of Agricultural and Food Chemistry 60:8528-8534					
Data Type:	Acute (0-96 hour); Terrestrial; other Plant: Maize					
Hero ID:	1927583					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 3:	Test Substance Purity	Medium	× 1	2	Purity not reported	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 6:	Randomized Allocation	Low	× 1	3	Allocation was not reported.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	Medium	× 2	4	Although test solutions were renewed everyday, its not clear how the exposure solution was mixed into the soil.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	Medium	× 1	2	The amount of HBCD in soil was not measured; only nominal concentrations were provided.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	Medium	× 1	2	Nominal concentrations were used, so there is uncertainty to how much HBCD was actually present despite claiming to set the initial concentrations below water solubility.	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
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Study Citation:	Wu, T.,Wang, S.,Huang, H.,Zhang, S.. 2012. Diastereomer-Specific Uptake, Translocation, and Toxicity of Hexabromocyclododecane Diastereoisomers to Maize. Journal of Agricultural and Food Chemistry 60:8528-8534					
Data Type:	Acute (0-96 hour); Terrestrial; other Plant: Maize					
Hero ID:	1927583					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 5: Outcome Assessment						
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note ‘***’ at the bottom of the table.	
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ‘***’ at the bottom of the table.	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ‘***’ at the bottom of the table.	
	Metric 20: Outcomes Unrelated to Exposure	Medium	× 1	2	Information on attrition unrelated to exposure were not reported.	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	High	× 1	1	See note ‘***’ at the bottom of the table.	
	Metric 22: Reporting of Data	High	× 2	2	See note ‘***’ at the bottom of the table.	
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ‘***’ at the bottom of the table.	
Overall Quality Determination [‡]		High		1.3		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases}$$

where High= ≥ 1 to < 1.7 ; Medium= ≥ 1.7 to < 2.4 ; Low= ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{***} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 15: Data Evaluation table for reference 1927590 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1927590).

Study Citation:	Martinson, S. C.,Bird, D. M.,Letcher, R. J.,Sullivan, K. M.,Ritchie, I. J.,Fernie, K. J.. 2012. Dietary exposure to technical hexabromocyclododecane (HBCD) alters courtship, incubation and parental behaviors in American kestrels (<i>Falco sparverius</i>). Chemosphere 89:1077-1083					
Data Type:	Other; Terrestrial; Birds					
Hero ID:	1927590					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^(***) at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^(***) at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	Technical grade	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^(***) at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note ^(***) at the bottom of the table.	
Metric 6:	Randomized Allocation	High	× 1	1	See note ^(***) at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^(***) at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^(***) at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	Medium	× 1	2	diet exposure; measured conc in egg to indicate exposure dose	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^(***) at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	Medium	× 1	2	One dose tested	
Metric 12:	Testing at or Below Solubility Limit	Medium	× 1	2	diet exposure; measured conc in egg to indicate exposure dose	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^(***) at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^(***) at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^(***) at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^(***) at the bottom of the table.	
Domain 5: Outcome Assessment						
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Study Citation:	Marteinson, S. C.,Bird, D. M.,Letcher, R. J.,Sullivan, K. M.,Ritchie, I. J.,Fernie, K. J.. 2012. Dietary exposure to technical hexabromocyclododecane (HBCD) alters courtship, incubation and parental behaviors in American kestrels (Falco sparverius). Chemosphere 89:1077-1083					
Data Type:	Other; Terrestrial; Birds					
Hero ID:	1927590					
Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}	
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note '***' at the bottom of the table.	
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note '***' at the bottom of the table.	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note '***' at the bottom of the table.	
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note '***' at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	High	× 1	1	See note '***' at the bottom of the table.	
	Metric 22: Reporting of Data	High	× 2	2	See note '***' at the bottom of the table.	
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note '***' at the bottom of the table.	
Overall Quality Determination [‡]		High		1.1		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 16: Data Evaluation table for reference 1927610 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1927610).

Study Citation:	Du, M.,Zhang, D.,Yan, C.,Zhang, X.. 2012. Developmental toxicity evaluation of three hexabromocyclododecane diastereoisomers on zebrafish embryos. Aquatic Toxicology					
Data Type:	Other;					
Hero ID:	1927610					
Domain		Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance						
	Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 3: Exposure Characterization						
	Metric 7:	Experimental System/Test Media Preparation	Medium	× 2	4	Unsure of volatilization, and no water concentrations were measured (all nominal).
	Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 9:	Measurement of Test Substance Concentration	Medium	× 1	2	nominal concentrations only reported
	Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 12:	Testing at or Below Solubility Limit	Medium	× 1	2	Many exposure concentrations above water solubility of different hbcd stereoisomers.
Domain 4: Test Organism						
	Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 5: Outcome Assessment						
	Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.
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Study Citation:	Du, M.,Zhang, D.,Yan, C.,Zhang, X.. 2012. Developmental toxicity evaluation of three hexabromocyclododecane diastereoisomers on zebrafish embryos. Aquatic Toxicology					
Data Type:	Other;					
Hero ID:	1927610					
Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}	
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
	Metric 22: Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.2		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lceil \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rceil_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High= ≥ 1 to < 1.7 ; Medium= ≥ 1.7 to < 2.4 ; Low= ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 17: Data Evaluation table for reference 1927629 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1927629).

Study Citation:	Fournier, A.,Feidt, C.,Marchand, P.,Vénisseau, A.,Le Bizec, B.,Sellier, N.,Engel, E.,Ratel, J.,Travel, A.,Jondreville, C.. 2012. Kinetic study of ”-hexabromocyclododecane orally given to laying hens (Gallus domesticus). ”Transfer of HBCD in laying hens”. Environmental Science and Pollution Research 19:440-447					
Data Type:	Chronic (>21 days); Terrestrial; Birds					
Hero ID:	1927629					
Domain		Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance						
	Metric 1:	Test Substance Identity	High	× 2	2	See note ^(***) at the bottom of the table.
	Metric 2:	Test Substance Source	High	× 1	1	See note ^(***) at the bottom of the table.
	Metric 3:	Test Substance Purity	High	× 1	1	See note ^(***) at the bottom of the table.
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	× 2	2	See note ^(***) at the bottom of the table.
	Metric 5:	Negative Control Response	High	× 1	1	See note ^(***) at the bottom of the table.
	Metric 6:	Randomized Allocation	High	× 1	1	See note ^(***) at the bottom of the table.
Domain 3: Exposure Characterization						
	Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^(***) at the bottom of the table.
	Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^(***) at the bottom of the table.
	Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ^(***) at the bottom of the table.
	Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^(***) at the bottom of the table.
	Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^(***) at the bottom of the table.
	Metric 12:	Testing at or Below Solubility Limit	High	× 1	1	See note ^(***) at the bottom of the table.
Domain 4: Test Organism						
	Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^(***) at the bottom of the table.
	Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^(***) at the bottom of the table.
	Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^(***) at the bottom of the table.
	Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^(***) at the bottom of the table.
Domain 5: Outcome Assessment						
	Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^(***) at the bottom of the table.
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Study Citation:	Fournier, A.,Feidt, C.,Marchand, P.,Vénisseau, A.,Le Bizec, B.,Sellier, N.,Engel, E.,Ratel, J.,Travel, A.,Jondreville, C.. 2012. Kinetic study of ”-hexabromocyclododecane orally given to laying hens (Gallus domesticus). ”Transfer of HBCD in laying hens”. Environmental Science and Pollution Research 19:440-447				
Data Type:	Chronic (>21 days); Terrestrial; Birds				
Hero ID:	1927629				
Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ‘***’ at the bottom of the table.
Domain 6: Confounding / Variable Control					
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note ‘***’ at the bottom of the table.
Domain 7: Data Presentation and Analysis					
	Metric 21: Statistical Methods	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 22: Reporting of Data	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ‘***’ at the bottom of the table.
Overall Quality Determination [‡]		High		1.0	
Extracted		Yes			

* MWF = Metric Weighting Factor

† High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

‡ The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases}$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

†† Reviewers document uncertainties and strengths for each metric, when deemed necessary.

*** Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 18: Data Evaluation table for reference 1927697 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1927697).

Study Citation:	Smolarz, K.,Berger, A.. 2009. Long-term toxicity of hexabromocyclododecane (HBCDD) to the benthic clam <i>Macoma balthica</i> (L.) from the Baltic Sea. <i>Aquatic Toxicology</i> 95:239-247					
Data Type:	Chronic (>21 days); Aquatic; Invertebrates					
Hero ID:	1927697					
Domain		Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance						
	Metric 1:	Test Substance Identity	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 2:	Test Substance Source	Low	× 1	3	not provided
	Metric 3:	Test Substance Purity	High	× 1	1	technical mixture of HBCDD
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 5:	Negative Control Response	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 6:	Randomized Allocation	High	× 1	1	See note ‘***’ at the bottom of the table.
Domain 3: Exposure Characterization						
	Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 9:	Measurement of Test Substance Concentration	Low	× 1	3	nominal conc; measured gill tissue conc every 10 days
	Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 12:	Testing at or Below Solubility Limit	Low	× 1	3	nominal conc; measured gill tissue conc every 10 days
Domain 4: Test Organism						
	Metric 13:	Test Organism Characteristics	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ‘***’ at the bottom of the table.
Domain 5: Outcome Assessment						
	Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ‘***’ at the bottom of the table.
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Study Citation:	Smolarz, K.,Berger, A.. 2009. Long-term toxicity of hexabromocyclododecane (HBCDD) to the benthic clam <i>Macoma balthica</i> (L.) from the Baltic Sea. <i>Aquatic Toxicology</i> 95:239-247				
Data Type:	Chronic (>21 days); Aquatic; Invertebrates				
Hero ID:	1927697				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ‘***’ at the bottom of the table.
Domain 6: Confounding / Variable Control					
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note ‘***’ at the bottom of the table.
Domain 7: Data Presentation and Analysis					
	Metric 21: Statistical Methods	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 22: Reporting of Data	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ‘***’ at the bottom of the table.
Overall Quality Determination [‡]		High		1.3	
Extracted		Yes			

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases}$$

where High= ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{***} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 19: Data Evaluation table for reference 1927716 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1927716).

Study Citation:	Deng, J.,Yu, L.,Liu, C.,Yu, K.,Shi, X.,Yeung, L. W.,Lam, P. K.,Wu, R. S.,Zhou, B.. 2009. Hexabromocyclododecane-induced developmental toxicity and apoptosis in zebrafish embryos. Aquatic Toxicology 93:29-36					
Data Type:	Acute (0-96 hour); Aquatic; Fish					
Hero ID:	1927716					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	N/A		N/A	See note ^{***} at the bottom of the table.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	Medium	× 1	2	Although the concentrations are above the water solubility for HBCD, DMSO was used as a solvent.	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 5: Outcome Assessment						
Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.	
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Study Citation:	Deng, J.,Yu, L.,Liu, C.,Yu, K.,Shi, X.,Yeung, L. W.,Lam, P. K.,Wu, R. S.,Zhou, B.. 2009. Hexabromocyclododecane-induced developmental toxicity and apoptosis in zebrafish embryos. Aquatic Toxicology 93:29-36					
Data Type:	Acute (0-96 hour); Aquatic; Fish					
Hero ID:	1927716					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
	Metric 22: Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.0		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases}$$

where High= ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 20: Data Evaluation table for reference 1927732 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1927732).

Study Citation:	Hu, J.,Liang, Y.,Chen, M.,Wang, X.. 2009. Assessing the toxicity of TBBPA and HBCD by zebrafish embryo toxicity assay and biomarker analysis. Environmental Toxicology 24:334-342					
Data Type:	Acute (0-96 hour); Aquatic; Fish					
Hero ID:	1927732					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 2: Test Design						
Metric 4:	Negative Controls	Medium	× 2	4	Used DMSO as a solvent	
Metric 5:	Negative Control Response	Medium	× 1	2	Used DMSO as a solvent	
Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 5: Outcome Assessment						
Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
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Study Citation:	Hu, J.,Liang, Y.,Chen, M.,Wang, X.. 2009. Assessing the toxicity of TBBPA and HBCD by zebrafish embryo toxicity assay and biomarker analysis. Environmental Toxicology 24:334-342				
Data Type:	Acute (0-96 hour); Aquatic; Fish				
Hero ID:	1927732				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 6: Confounding / Variable Control					
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note '***' at the bottom of the table.
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note '***' at the bottom of the table.
Domain 7: Data Presentation and Analysis					
	Metric 21: Statistical Methods	High	× 1	1	See note '***' at the bottom of the table.
	Metric 22: Reporting of Data	High	× 2	2	See note '***' at the bottom of the table.
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note '***' at the bottom of the table.
Overall Quality Determination [‡]		High		1.1	
Extracted		Yes			

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High= ≥ 1 to < 1.7 ; Medium= ≥ 1.7 to < 2.4 ; Low= ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 21: Data Evaluation table for reference 1927768 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1927768).

Study Citation:	Zhang, X.,Yang, F.,Zhang, X.,Xu, Y.,Liao, T.,Song, S.,Wang, J.. 2008. Induction of hepatic enzymes and oxidative stress in Chinese rare minnow (<i>Gobiocypris rarus</i>) exposed to waterborne hexabromocyclododecane (HBCDD). Aquatic Toxicology 86					
Data Type:	Chronic (>21 days); Aquatic; Fish					
Hero ID:	1927768					
Domain		Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance						
	Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 2: Test Design						
	Metric 4:	Negative Controls	Medium	× 2	4	The control fish were exposed to the nominal concentration of 0.06” DMSO, corresponding to the highest percentage volume of DMSO used in the HBCDD treatments. Unsure of DMSO concentration or percentage volume in all treatment groups.
	Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 6:	Randomized Allocation	Low	× 1	3	Allocation not reported
Domain 3: Exposure Characterization						
	Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 8:	Consistency of Exposure Administration	Medium	× 1	2	Control fish were only exposed to one concentration of DMSO that corresponds with the nominal amount reported for the highest concentration of HBCD; unsure of solvent concentrations in other HBCD concentrations.
	Metric 9:	Measurement of Test Substance Concentration	Medium	× 1	2	Only nominal concentrations used/reported.
	Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 12:	Testing at or Below Solubility Limit	Medium	× 1	2	Some exposure concentrations exceeded water solubility.
Domain 4: Test Organism						
	Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.
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Study Citation:	Zhang, X.,Yang, F.,Zhang, X.,Xu, Y.,Liao, T.,Song, S.,Wang, J.. 2008. Induction of hepatic enzymes and oxidative stress in Chinese rare minnow (<i>Gobiocypris rarus</i>) exposed to waterborne hexabromocyclododecane (HBCDD). <i>Aquatic Toxicology</i> 86					
Data Type:	Chronic (>21 days); Aquatic; Fish					
Hero ID:	1927768					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
	Metric 14: Acclimitization and Pretreatment Conditions	Low	× 1	3	No mentioning of acclimatization and pre-treatment conditions, and DMSO concentrations may have differed between treatments	
	Metric 15: Number of Organisms and Replicates per Group	Low	× 1	3	45 fish were used per group, but the number of reps per exposure group was not explicitly mentioned. Also not sure if blood and serum samples were pooled for analysis between time sampling points.	
	Metric 16: Adequacy of Test Conditions	High	× 1	1	See note '***' at the bottom of the table.	
Domain 5: Outcome Assessment						
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note '***' at the bottom of the table.	
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note '***' at the bottom of the table.	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	Medium	× 2	4	DMSO concentration differ between treatment groups,.	
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note '***' at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	High	× 1	1	See note '***' at the bottom of the table.	
	Metric 22: Reporting of Data	High	× 2	2	See note '***' at the bottom of the table.	
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note '***' at the bottom of the table.	
Overall Quality Determination [‡]		High		1.5		
Extracted		Yes				
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Study Citation: Zhang, X.,Yang, F.,Zhang, X.,Xu, Y.,Liao, T.,Song, S.,Wang, J.. 2008. Induction of hepatic enzymes and oxidative stress in Chinese rare minnow (*Gobiocypris rarus*) exposed to waterborne hexabromocyclododecane (HBCDD). *Aquatic Toxicology* 86

Data Type: Chronic (>21 days); Aquatic; Fish

Hero ID: 1927768

Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}
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* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High= ≥ 1 to < 1.7 ; Medium= ≥ 1.7 to < 2.4 ; Low= ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 22: Data Evaluation table for reference 1927821 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1927821).

Study Citation:	Ronisz, D.,Finne, E. F.,Karlsson, H.,Förlin, L.. 2004. Effects of the brominated flame retardants hexabromocyclododecane (HBCDD), and tetrabromobisphenol A (TBBPA), on hepatic enzymes and other biomarkers in juvenile rainbow trout and feral eelpout. Aquatic Toxicology 69:229-245				
Data Type:	Other; Aquatic; Fish				
Hero ID:	1927821				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance					
Metric 1:	Test Substance Identity	High	× 2	2	See note ‘***’ at the bottom of the table.
Metric 2:	Test Substance Source	Medium	× 1	2	Source provided but not additional information
Metric 3:	Test Substance Purity	Low	× 1	3	Grade/Purity not reported
Domain 2: Test Design					
Metric 4:	Negative Controls	High	× 2	2	See note ‘***’ at the bottom of the table.
Metric 5:	Negative Control Response	High	× 1	1	See note ‘***’ at the bottom of the table.
Metric 6:	Randomized Allocation	Low	× 1	3	Allocation not reported
Domain 3: Exposure Characterization					
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ‘***’ at the bottom of the table.
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ‘***’ at the bottom of the table.
Metric 9:	Measurement of Test Substance Concentration	Medium	× 1	2	nominal injection studies
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ‘***’ at the bottom of the table.
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ‘***’ at the bottom of the table.
Metric 12:	Testing at or Below Solubility Limit	Medium	× 1	2	nominal injection studies
Domain 4: Test Organism					
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ‘***’ at the bottom of the table.
Metric 14:	Acclimatization and Pretreatment Conditions	High	× 1	1	See note ‘***’ at the bottom of the table.
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ‘***’ at the bottom of the table.
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ‘***’ at the bottom of the table.
Domain 5: Outcome Assessment					
Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ‘***’ at the bottom of the table.
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Study Citation:	Ronisz, D.,Finne, E. F.,Karlsson, H.,Förlin, L.. 2004. Effects of the brominated flame retardants hexabromocyclododecane (HBCDD), and tetrabromobisphenol A (TBBPA), on hepatic enzymes and other biomarkers in juvenile rainbow trout and feral eelpout. Aquatic Toxicology 69:229-245				
Data Type:	Other; Aquatic; Fish				
Hero ID:	1927821				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ‘***’ at the bottom of the table.
Domain 6: Confounding / Variable Control					
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note ‘***’ at the bottom of the table.
Domain 7: Data Presentation and Analysis					
	Metric 21: Statistical Methods	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 22: Reporting of Data	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ‘***’ at the bottom of the table.
Overall Quality Determination [‡]		High		1.3	
Extracted		Yes			

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

****** Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. **(a)** High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. **(b)** Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. **(c)** Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. **(d)** Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. **(e)** Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 23: Data Evaluation table for reference 1927837 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1927837).

Study Citation:	Walsh, G. E.,Yoder, M. J.,McLaughlin, L. L.,Lores, E. M.. 1987. Responses of marine unicellular algae to brominated organic compounds in six growth media. Ecotoxicology and Environmental Safety 14:215-222				
Data Type:	Acute (0-96 hour); Aquatic; Plants				
Hero ID:	1927837				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance					
Metric 1:	Test Substance Identity	High	× 2	2	This study was conducted by the U.S. Environmental Protection Agency (Environmental Research Laboratory, Gulf Breeze, Florida). Although the reporting source for this study lack specific details about the test substance, the information on this metric can be found in other sources.
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.
Metric 3:	Test Substance Purity	Low	× 1	3	This study was conducted by the U.S. Environmental Protection Agency (Environmental Research Laboratory, Gulf Breeze, Florida). Although the reporting source for this study lack specific details about the test substance, the information on this metric can be found in other sources.
Domain 2: Test Design					
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.
Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.
Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 3: Exposure Characterization					
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.
Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ^{***} at the bottom of the table.
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.
Metric 12:	Testing at or Below Solubility Limit	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 4: Test Organism					
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.
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Study Citation:	Walsh, G. E.,Yoder, M. J.,McLaughlin, L. L.,Lores, E. M.. 1987. Responses of marine unicellular algae to brominated organic compounds in six growth media. Ecotoxicology and Environmental Safety 14:215-222					
Data Type:	Acute (0-96 hour); Aquatic; Plants					
Hero ID:	1927837					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
	Metric 14: Acclimitization and Pretreatment Conditions	High	× 1	1	See note ‘***’ at the bottom of the table.	
	Metric 15: Number of Organisms and Replicates per Group	High	× 1	1	See note ‘***’ at the bottom of the table.	
	Metric 16: Adequacy of Test Conditions	High	× 1	1	See note ‘***’ at the bottom of the table.	
Domain 5: Outcome Assessment						
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note ‘***’ at the bottom of the table.	
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ‘***’ at the bottom of the table.	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ‘***’ at the bottom of the table.	
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note ‘***’ at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	High	× 1	1	See note ‘***’ at the bottom of the table.	
	Metric 22: Reporting of Data	High	× 2	2	See note ‘***’ at the bottom of the table.	
	Metric 23: Explanation of Unexpected Outcomes	N/A		N/A	See note ‘***’ at the bottom of the table.	
Overall Quality Determination [‡]		High		1.1		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lceil \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rceil_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases}$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 24: Data Evaluation table for reference 1927956 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1927956).

Study Citation:	Lower, N.,Moore, A.. 2007. The impact of a brominated flame retardant on smoltification and olfactory function in Atlantic salmon (Salmo salar L.) smolts. Marine and Freshwater Behaviour and Physiology 40:267-284					
Data Type:	Chronic (>21 days); Aquatic; Fish					
Hero ID:	1927956					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	Technical grade.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 5: Outcome Assessment						
Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
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Study Citation:	Lower, N.,Moore, A.. 2007. The impact of a brominated flame retardant on smoltification and olfactory function in Atlantic salmon (Salmo salar L.) smolts. Marine and Freshwater Behaviour and Physiology 40:267-284					
Data Type:	Chronic (>21 days); Aquatic; Fish					
Hero ID:	1927956					
Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}	
Domain 6: Confounding / Variable Control						
Metric 19:	Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 20:	Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
Metric 21:	Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 22:	Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 23:	Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.0		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High= ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{***} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 25: Data Evaluation table for reference 1928024 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1928024).

Study Citation:	Zhang, H. ui,Pan, L.,Tao, Y.,Tian, S.,Hu, Y.. 2013. Identification and expression of differentially expressed genes in clam Venerupis philippinarum in response to environmental pollutant hexabromocyclododecane (HBCD). Journal of Experimental Marine Biology and Ecology 445:166-173					
Data Type:	Other; Aquatic; Sediment-dwelling					
Hero ID:	1928024					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	Unacceptable		4	no mention of HBCD source, purity, or structure	
Metric 2:	Test Substance Source	Low	× 1	3	no mention of HBCD source, purity, or structure	
Metric 3:	Test Substance Purity	Low	× 1	3	no mention of HBCD source, purity, or structure	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 5:	Negative Control Response	Unacceptable		4	biological responses of control not reported	
Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	Medium	× 2	4	Some information provided, but no details available on reducing HBCD loss.	
Metric 8:	Consistency of Exposure Administration	Low	× 1	3	not many details on exposure administration besides the daily static renewals	
Metric 9:	Measurement of Test Substance Concentration	Medium	× 1	2	only nominal concentrations provided	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	Medium	× 1	2	Only nominal concentrations provided but one concentration reported to be above water solubility	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
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Study Citation:	Zhang, H. ui,Pan, L.,Tao, Y.,Tian, S.,Hu, Y.. 2013. Identification and expression of differentially expressed genes in clam Venerupis philippinarum in response to environmental pollutant hexabromocyclododecane (HBCD). Journal of Experimental Marine Biology and Ecology 445:166-173				
Data Type:	Other; Aquatic; Sediment-dwelling				
Hero ID:	1928024				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 5: Outcome Assessment					
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note ^{‘***’} at the bottom of the table.
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ^{‘***’} at the bottom of the table.
Domain 6: Confounding / Variable Control					
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{‘***’} at the bottom of the table.
	Metric 20: Outcomes Unrelated to Exposure	Medium	× 1	2	no unrelated outcomes were reported
Domain 7: Data Presentation and Analysis					
	Metric 21: Statistical Methods	High	× 1	1	See note ^{‘***’} at the bottom of the table.
	Metric 22: Reporting of Data	High	× 2	2	See note ^{‘***’} at the bottom of the table.
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ^{‘***’} at the bottom of the table.
Overall Quality Determination [‡]		Unacceptable		4.0	
Extracted		Yes			

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High= ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 26: Data Evaluation table for reference 1928244 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1928244).

Study Citation:	. 2000. LETTER FROM AMER CHEM CNCL SUBMITTING FLOW-THROUGH BIOCONCENTRATION TEST W/RAINBOW TROUT and END-USER SURVEY-PHASE 1 STUDY OF BROMINATED FLAME RETARDANT, W/ATTCHMTS and DATED 8/28/00.					
Data Type:	Acute (0-96 hour); Aquatic; Fish					
Hero ID:	1928244					
Domain		Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance						
	Metric 1:	Test Substance Identity	High	× 2	2	See note ^(***) at the bottom of the table.
	Metric 2:	Test Substance Source	High	× 1	1	See note ^(***) at the bottom of the table.
	Metric 3:	Test Substance Purity	High	× 1	1	See note ^(***) at the bottom of the table.
Domain 2: Test Design						
	Metric 4:	Negative Controls	Low	× 2	6	See note ^(***) at the bottom of the table.
	Metric 5:	Negative Control Response	Low	× 1	3	See note ^(***) at the bottom of the table.
	Metric 6:	Randomized Allocation	Low	× 1	3	See note ^(***) at the bottom of the table.
Domain 3: Exposure Characterization						
	Metric 7:	Experimental System/Test Media Preparation	Low	× 2	6	See note ^(***) at the bottom of the table.
	Metric 8:	Consistency of Exposure Administration	Low	× 1	3	See note ^(***) at the bottom of the table.
	Metric 9:	Measurement of Test Substance Concentration	Low	× 1	3	See note ^(***) at the bottom of the table.
	Metric 10:	Exposure Duration and Frequency	Low	× 2	6	See note ^(***) at the bottom of the table.
	Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	Low	× 1	3	See note ^(***) at the bottom of the table.
	Metric 12:	Testing at or Below Solubility Limit	Low	× 1	3	See note ^(***) at the bottom of the table.
Domain 4: Test Organism						
	Metric 13:	Test Organism Characteristics	Low	× 2	6	See note ^(***) at the bottom of the table.
	Metric 14:	Acclimitization and Pretreatment Conditions	Low	× 1	3	See note ^(***) at the bottom of the table.
	Metric 15:	Number of Organisms and Replicates per Group	Low	× 1	3	See note ^(***) at the bottom of the table.
	Metric 16:	Adequacy of Test Conditions	Low	× 1	3	See note ^(***) at the bottom of the table.
Domain 5: Outcome Assessment						
	Metric 17:	Outcome Assessment Methodology	Low	× 2	6	See note ^(***) at the bottom of the table.
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Study Citation:	. 2000. LETTER FROM AMER CHEM CNCL SUBMITTING FLOW-THROUGH BIOCONCENTRATION TEST W/RAINBOW TROUT and END-USER SURVEY-PHASE 1 STUDY OF BROMINATED FLAME RETARDANT, W/ATTCHMTS and DATED 8/28/00.				
Data Type:	Acute (0-96 hour); Aquatic; Fish				
Hero ID:	1928244				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
	Metric 18: Consistency of Outcome Assessment	Low	× 1	3	See note *** at the bottom of the table.
Domain 6: Confounding / Variable Control					
	Metric 19: Confounding Variables in Test Design and Procedures	Low	× 2	6	See note *** at the bottom of the table.
	Metric 20: Outcomes Unrelated to Exposure	Low	× 1	3	See note *** at the bottom of the table.
Domain 7: Data Presentation and Analysis					
	Metric 21: Statistical Methods	Low	× 1	3	See note *** at the bottom of the table.
	Metric 22: Reporting of Data	Low	× 2	6	See note *** at the bottom of the table.
	Metric 23: Explanation of Unexpected Outcomes	Low	× 1	3	See note *** at the bottom of the table.
Overall Quality Determination [‡]		Low → Medium		2.7	The primary purpose for this study was to determine the potential of HBCD to bioconcentrate in fish. However, preliminary information about the toxicity is always reported with this type of test. Although limited information is available in the reporting document, supplementary informations on the acute toxicity endpoint has been reported.
Extracted		Yes			

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases}$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{***} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 27: Data Evaluation table for reference 1928244 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1928244).

Study Citation:	. 2000. LETTER FROM AMER CHEM CNCL SUBMITTING FLOW-THROUGH BIOCONCENTRATION TEST W/RAINBOW TROUT and END-USER SURVEY-PHASE 1 STUDY OF BROMINATED FLAME RETARDANT, W/ATTCHMTS and DATED 8/28/00.					
Data Type:	Other; Aquatic; Fish					
Hero ID:	1928244					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^(***) at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^(***) at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	See note ^(***) at the bottom of the table.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^(***) at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note ^(***) at the bottom of the table.	
Metric 6:	Randomized Allocation	High	× 1	1	See note ^(***) at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^(***) at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^(***) at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ^(***) at the bottom of the table.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^(***) at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^(***) at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	High	× 1	1	See note ^(***) at the bottom of the table.	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^(***) at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^(***) at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^(***) at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^(***) at the bottom of the table.	
Domain 5: Outcome Assessment						
Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^(***) at the bottom of the table.	
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Study Citation:	. 2000. LETTER FROM AMER CHEM CNCL SUBMITTING FLOW-THROUGH BIOCONCENTRATION TEST W/RAINBOW TROUT and END-USER SURVEY-PHASE 1 STUDY OF BROMINATED FLAME RETARDANT, W/ATTCHMTS and DATED 8/28/00.				
Data Type:	Other; Aquatic; Fish				
Hero ID:	1928244				
Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 6: Confounding / Variable Control					
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 7: Data Presentation and Analysis					
	Metric 21: Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 22: Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.
Overall Quality Determination [‡]		High		1.0	
Extracted		Yes			

* MWF = Metric Weighting Factor

† High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

‡ The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases}$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

†† Reviewers document uncertainties and strengths for each metric, when deemed necessary.

*** Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 28: Data Evaluation table for reference 1928267 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1928267).

Study Citation:	Basf,. 1990. Determination of the acute toxicity of hexabromid S to the waterflea Daphnia magna straus with cover letter dated 040590.					
Data Type:	Acute (0-96 hour); Aquatic; Invertebrates					
Hero ID:	1928267					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	Low	× 1	3	Only nominal concentrations are reported	
Metric 10:	Exposure Duration and Frequency	nan	× 2	6	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	Low	× 1	3	only nominal concentrations were reported	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 5: Outcome Assessment						
Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
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Study Citation:	Basf,. 1990. Determination of the acute toxicity of hexabromid S to the waterflea Daphnia magna straus with cover letter dated 040590.					
Data Type:	Acute (0-96 hour); Aquatic; Invertebrates					
Hero ID:	1928267					
Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}	
Domain 6: Confounding / Variable Control						
Metric 19:	Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 20:	Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
Metric 21:	Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 22:	Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 23:	Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.2		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 29: Data Evaluation table for reference 1928289 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/1928289).

Study Citation:	. 1994. INITIAL SUBMISSION: LETTER FROM GREAT LAKES CHEM CORP TO DYNAMAC CORP/USEPA SUBMITTING INFO RE HEXABROMOCYCLODODECANE AND BIS(TRIBROMOPHENOXY) ETHANE W/ATTCHMTS, DATED 2/13/89.					
Data Type:	Acute (0-96 hour); Aquatic; Fish					
Hero ID:	1928289					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2		
Metric 2:	Test Substance Source	High	× 1	1		
Metric 3:	Test Substance Purity	Low	× 1	3	not reported	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2		
Metric 5:	Negative Control Response	High	× 1	1		
Metric 6:	Randomized Allocation	High	× 1	1		
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2		
Metric 8:	Consistency of Exposure Administration	High	× 1	1		
Metric 9:	Measurement of Test Substance Concentration	Low	× 1	3	nominal	
Metric 10:	Exposure Duration and Frequency	High	× 2	2		
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1		
Metric 12:	Testing at or Below Solubility Limit	Low	× 1	3	nominal conc	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2		
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1		
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1		
Metric 16:	Adequacy of Test Conditions	High	× 1	1		
Domain 5: Outcome Assessment						
Metric 17:	Outcome Assessment Methodology	High	× 2	2		
Metric 18:	Consistency of Outcome Assessment	High	× 1	1		
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Study Citation:	. 1994. INITIAL SUBMISSION: LETTER FROM GREAT LAKES CHEM CORP TO DYNAMAC CORP/USEPA SUBMITTING INFO RE HEXABROMOCYCLODODECANE AND BIS(TRIBROMOPHENOXY) ETHANE W/ATTCHMTS, DATED 2/13/89.				
Data Type:	Acute (0-96 hour); Aquatic; Fish				
Hero ID:	1928289				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 6: Confounding / Variable Control					
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	
Domain 7: Data Presentation and Analysis					
	Metric 21: Statistical Methods	High	× 1	1	
	Metric 22: Reporting of Data	High	× 2	2	
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	
Overall Quality Determination [‡]		High		1.3	
Extracted		Yes			

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases}$$

where High= ≥ 1 to < 1.7 ; Medium= ≥ 1.7 to < 2.4 ; Low= ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 30: Data Evaluation table for reference 2343684 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/2343684).

Study Citation:	Hong, H.,Li, D.,Shen, R.,Wang, X.,Shi, D.. 2014. Mechanisms of hexabromocyclododecanes induced developmental toxicity in marine medaka (<i>Oryzias melastigma</i>) embryos. <i>Aquatic Toxicology</i> 152:173-185					
Data Type:	Other; Aquatic; Fish					
Hero ID:	2343684					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	Medium	× 1	2	Nominal concentrations were reported for exposure treatments, but daily renewals did occur, alleviating some concerns.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	Medium	× 1	2	Nominal concentrations reported and most of the exposure concentrations are below water solubility of HBCD.	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 5: Outcome Assessment						
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Study Citation:	Hong, H.,Li, D.,Shen, R.,Wang, X.,Shi, D.. 2014. Mechanisms of hexabromocyclododecanes induced developmental toxicity in marine medaka (<i>Oryzias melastigma</i>) embryos. <i>Aquatic Toxicology</i> 152:173-185					
Data Type:	Other; Aquatic; Fish					
Hero ID:	2343684					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note ^{‘***’} at the bottom of the table.	
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ^{‘***’} at the bottom of the table.	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{‘***’} at the bottom of the table.	
	Metric 20: Outcomes Unrelated to Exposure	Medium	× 1	2	no unrelated outcomes were reported	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	Low	× 1	3	statistical methods were not reported but how comparisons were made for each endpoint are discussed	
	Metric 22: Reporting of Data	High	× 2	2	See note ^{‘***’} at the bottom of the table.	
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ^{‘***’} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.2		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High= ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{***} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 31: Data Evaluation table for reference 2343690 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/2343690).

Study Citation:	Zhang, Y.,Sun, H.,Zhu, H.,Ruan, Y.,Liu, F.,Liu, X.. 2014. Accumulation of hexabromocyclododecane diastereomers and enantiomers in two microalgae, Spirulina subsalsa and Scenedesmus obliquus. Ecotoxicology and Environmental Safety 104:136-142					
Data Type:	Other; Aquatic; Plants					
Hero ID:	2343690					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 3:	Test Substance Purity	Low	× 1	3	Purity not reported.	
Domain 2: Test Design						
Metric 4:	Negative Controls	Unacceptable		4	none reported	
Metric 5:	Negative Control Response	Unacceptable		4	no control results provided, except that there was no background HBCD	
Metric 6:	Randomized Allocation	Low	× 1	3	Exposure treatment group allocation was not reported.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	Medium	× 1	2	Only one exposure concentration (2 ng/mL) used for each stereoisomer, for both algal species.	
Metric 12:	Testing at or Below Solubility Limit	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 5: Outcome Assessment						
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Study Citation:	Zhang, Y.,Sun, H.,Zhu, H.,Ruan, Y.,Liu, F.,Liu, X.. 2014. Accumulation of hexabromocyclododecane diastereomers and enantiomers in two microalgae, Spirulina subsalsa and Scenedesmus obliquus. Ecotoxicology and Environmental Safety 104:136-142					
Data Type:	Other; Aquatic; Plants					
Hero ID:	2343690					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
	Metric 22: Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		Unacceptable		4.0		
Extracted		Yes				

* MWF = Metric Weighting Factor

† High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

‡ The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases}$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

†† Reviewers document uncertainties and strengths for each metric, when deemed necessary.

** Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 32: Data Evaluation table for reference 2343709 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/2343709).

Study Citation:	Foekema, E. M.,Lopez Parron, M.,Mergia, M. T.,Carolus, E. R.,Vd Berg, J. H.,Kwadijk, C.,Dao, Q.,Murk, A. J.. 2014. Internal effect concentrations of organic substances for early life development of egg-exposed fish. Ecotoxicology and Environmental Safety 101:14-22					
Data Type:	Chronic (>21 days); Aquatic; Fish					
Hero ID:	2343709					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	Survival were higher that the experimental groups.	
Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	Low	× 1	3	Used DMSO as a solvent	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	Medium	× 2	4	Not on the list of recommended species.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 5: Outcome Assessment						
Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
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Study Citation:	Foekema, E. M.,Lopez Parron, M.,Mergia, M. T.,Carolus, E. R.,Vd Berg, J. H.,Kwadijk, C.,Dao, Q.,Murk, A. J.. 2014. Internal effect concentrations of organic substances for early life development of egg-exposed fish. Ecotoxicology and Environmental Safety 101:14-22				
Data Type:	Chronic (>21 days); Aquatic; Fish				
Hero ID:	2343709				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 6: Confounding / Variable Control					
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note '***' at the bottom of the table.
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note '***' at the bottom of the table.
Domain 7: Data Presentation and Analysis					
	Metric 21: Statistical Methods	High	× 1	1	See note '***' at the bottom of the table.
	Metric 22: Reporting of Data	High	× 2	2	See note '***' at the bottom of the table.
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note '***' at the bottom of the table.
Overall Quality Determination [‡]		High		1.1	
Extracted		Yes			

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High= ≥ 1 to < 1.7 ; Medium= ≥ 1.7 to < 2.4 ; Low= ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 33: Data Evaluation table for reference 2343723 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/2343723).

Study Citation:	Zhang, Y.,Sun, H.,Ruan, Y.. 2014. Enantiomer-specific accumulation, depuration, metabolization and isomerization of hexabromocyclododecane (HBCD) diastereomers in mirror carp from water. Journal of Hazardous Materials 264					
Data Type:	Chronic (>21 days); Aquatic; Fish					
Hero ID:	2343723					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	Low	× 1	3	not addressed	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 5: Outcome Assessment						
Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
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Study Citation:	Zhang, Y.,Sun, H.,Ruan, Y.. 2014. Enantiomer-specific accumulation, depuration, metabolization and isomerization of hexabromocyclododecane (HBCD) diastereomers in mirror carp from water. Journal of Hazardous Materials 264					
Data Type:	Chronic (>21 days); Aquatic; Fish					
Hero ID:	2343723					
Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}	
Domain 6: Confounding / Variable Control						
Metric 19:	Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 20:	Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
Metric 21:	Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 22:	Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 23:	Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.1		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High= ≥ 1 to < 1.7 ; Medium= ≥ 1.7 to < 2.4 ; Low= ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{***} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 34: Data Evaluation table for reference 2528343 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/2528343).

Study Citation:	Zhang, H.,Pan, L.,Tao, Y.. 2014. Antioxidant responses in clam <i>Venerupis philippinarum</i> exposed to environmental pollutant hexabromocyclododecane. Environmental Science and Pollution Research 21:8206-8215					
Data Type:	Other; Aquatic; Sediment-dwelling					
Hero ID:	2528343					
Domain		Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance						
	Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 3:	Test Substance Purity	Low	× 1	3	substance purity not reported
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 6:	Randomized Allocation	Low	× 1	3	There was no report on how organisms were allocated to study groups.
Domain 3: Exposure Characterization						
	Metric 7:	Experimental System/Test Media Preparation	Low	× 2	6	exposure system and water quality details/conditions were not reported
	Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 9:	Measurement of Test Substance Concentration	Medium	× 1	2	nominal concentrations reported
	Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 12:	Testing at or Below Solubility Limit	Medium	× 1	2	Two exposure concentrations above water solubility
Domain 4: Test Organism						
	Metric 13:	Test Organism Characteristics	Low	× 2	6	Clams are an appropriate test organism for sediment/legacy contaminants, but there is a deficiency in organism age/characteristics.
	Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 16:	Adequacy of Test Conditions	Medium	× 1	2	Some uncertainties about diet/water conditions during the exposure since information was provided for the acclimation period.
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Study Citation:	Zhang, H.,Pan, L.,Tao, Y.. 2014. Antioxidant responses in clam Venerupis philippinarum exposed to environmental pollutant hexabromocyclododecane. Environmental Science and Pollution Research 21:8206-8215					
Data Type:	Other; Aquatic; Sediment-dwelling					
Hero ID:	2528343					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 5: Outcome Assessment						
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 20: Outcomes Unrelated to Exposure	Medium	× 1	2	no unrelated outcomes were reported	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
	Metric 22: Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.5		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High= ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{***} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 35: Data Evaluation table for reference 2965902 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/2965902).

Study Citation:	Shi, Y. J., Xu, X. B., Zheng, X. Q., Lu, Y. L.. 2015. Responses of growth inhibition and antioxidant gene expression in earthworms (<i>Eisenia fetida</i>) exposed to tetrabromobisphenol A, hexabromocyclododecane and decabromodiphenyl ether. Comparative Biochemistry and Physiology - Part C: Toxicology and Pharmacology					
Data Type:	Other; Terrestrial; Invertebrate					
Hero ID:	2965902					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 6:	Randomized Allocation	Medium	× 1	2	Samples were randomly selected for destructive sampling at different time points, but it was not mentioned whether organisms were randomly allocated to treatment groups.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	Medium	× 2	4	No report on soil renewals (likely only dosed once at the beginning), and there were not measured data on soil HBCD concentrations following various sampling time points.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	Medium	× 1	2	Only nominal concentrations are reported.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	N/A		N/A	soil exposure	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.	
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Study Citation:	Shi, Y. J., Xu, X. B., Zheng, X. Q., Lu, Y. L.. 2015. Responses of growth inhibition and antioxidant gene expression in earthworms (<i>Eisenia fetida</i>) exposed to tetrabromobisphenol A, hexabromocyclododecane and decabromodiphenyl ether. Comparative Biochemistry and Physiology - Part C: Toxicology and Pharmacology				
Data Type:	Other; Terrestrial; Invertebrate				
Hero ID:	2965902				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
Metric 16:	Adequacy of Test Conditions	Low	× 1	3	Limited details available on feeding, and conditions of the exposure, but authors cited OECD 1984 for cultivation (not experiment protocol).
Domain 5: Outcome Assessment					
Metric 17:	Outcome Assessment Methodology	High	× 2	2	all reported
Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ‘***’ at the bottom of the table.
Domain 6: Confounding / Variable Control					
Metric 19:	Confounding Variables in Test Design and Procedures	High	× 2	2	See note ‘***’ at the bottom of the table.
Metric 20:	Outcomes Unrelated to Exposure	High	× 1	1	See note ‘***’ at the bottom of the table.
Domain 7: Data Presentation and Analysis					
Metric 21:	Statistical Methods	High	× 1	1	See note ‘***’ at the bottom of the table.
Metric 22:	Reporting of Data	High	× 2	2	See note ‘***’ at the bottom of the table.
Metric 23:	Explanation of Unexpected Outcomes	High	× 1	1	See note ‘***’ at the bottom of the table.
Overall Quality Determination [‡]		High		1.2	
Extracted		Yes			

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lceil \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rceil_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 36: Data Evaluation table for reference 3350472 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/3350472).

Study Citation:	Wu, T.,Huang, H.,Zhang, S.. 2016. Accumulation and phytotoxicity of technical hexabromocyclododecane in maize. Journal of Environmental Sciences 42:97-104					
Data Type:	Acute (0-96 hour); Terrestrial; other Plant					
Hero ID:	3350472					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ‘***’ at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ‘***’ at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	See note ‘***’ at the bottom of the table.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ‘***’ at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note ‘***’ at the bottom of the table.	
Metric 6:	Randomized Allocation	High	× 1	1	See note ‘***’ at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ‘***’ at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ‘***’ at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	Low	× 1	3	Nominal daily renewal	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ‘***’ at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ‘***’ at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	Low	× 1	3	not addressed; nominal daily renewal	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ‘***’ at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ‘***’ at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ‘***’ at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ‘***’ at the bottom of the table.	
Domain 5: Outcome Assessment						
Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ‘***’ at the bottom of the table.	
Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ‘***’ at the bottom of the table.	
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Study Citation:	Wu, T.,Huang, H.,Zhang, S.. 2016. Accumulation and phytotoxicity of technical hexabromocyclododecane in maize. Journal of Environmental Sciences 42:97-104					
Data Type:	Acute (0-96 hour); Terrestrial; other Plant					
Hero ID:	3350472					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 6: Confounding / Variable Control						
Metric 19:	Confounding Variables in Test Design and Procedures	High	× 2	2	See note ‘***’ at the bottom of the table.	
Metric 20:	Outcomes Unrelated to Exposure	High	× 1	1	See note ‘***’ at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
Metric 21:	Statistical Methods	High	× 1	1	See note ‘***’ at the bottom of the table.	
Metric 22:	Reporting of Data	High	× 2	2	See note ‘***’ at the bottom of the table.	
Metric 23:	Explanation of Unexpected Outcomes	High	× 1	1	See note ‘***’ at the bottom of the table.	
Overall Quality Determination [‡]		High		1.2		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High= ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{***} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 37: Data Evaluation table for reference 3350492 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/3350492).

Study Citation:	Zhu, H.,Sun, H.,Zhang, Y.,Xu, J.,Li, B.,Zhou, Q.. 2016. Uptake Pathway, Translocation, and Isomerization of Hexabromocyclododecane Diastereoisomers by Wheat in Closed Chambers. Environmental Science and Technology 50:2652-2659					
Data Type:	Other; Terrestrial; other Plant					
Hero ID:	3350492					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 5: Outcome Assessment						
Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
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Study Citation:	Zhu, H.,Sun, H.,Zhang, Y.,Xu, J.,Li, B.,Zhou, Q.. 2016. Uptake Pathway, Translocation, and Isomerization of Hexabromocyclododecane Diastereoisomers by Wheat in Closed Chambers. Environmental Science and Technology 50:2652-2659					
Data Type:	Other; Terrestrial; other Plant					
Hero ID:	3350492					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 6: Confounding / Variable Control						
Metric 19:	Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 20:	Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
Metric 21:	Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 22:	Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 23:	Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.0		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases}$$

where High= ≥ 1 to < 1.7 ; Medium= ≥ 1.7 to < 2.4 ; Low= ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{***} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 38: Data Evaluation table for reference 3350507 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/3350507).

Study Citation:	Hong, H.,Shen, R.,Liu, W.,Li, D.,Huang, L.,Shi, D.. 2015. Developmental toxicity of three hexabromocyclododecane diastereoisomers in embryos of the marine medaka <i>Oryzias melastigma</i> . Marine Pollution Bulletin 101:110-118					
Data Type:	Other; Aquatic; Fish					
Hero ID:	3350507					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	Medium	× 2	4	No mentioning of whether the testing media renewals accounted for maintaining HBCD exposure concentration consistency.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	Medium	× 1	2	All HBCD concentrations are above water solubility (except for the control).	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	Medium	× 2	4	Source not revealed, although it is assumed by "collected daily" that there is a lab culture.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 5: Outcome Assessment						
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Study Citation:	Hong, H.,Shen, R.,Liu, W.,Li, D.,Huang, L.,Shi, D.. 2015. Developmental toxicity of three hexabromocyclododecane diastereoisomers in embryos of the marine medaka <i>Oryzias melastigma</i> . Marine Pollution Bulletin 101:110-118					
Data Type:	Other; Aquatic; Fish					
Hero ID:	3350507					
Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}	
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
	Metric 22: Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.2		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

****** Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. **(a)** High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. **(b)** Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. **(c)** Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. **(d)** Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. **(e)** Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 39: Data Evaluation table for reference 3350510 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/3350510).

Study Citation:	Li, B.,Yao, T.,Sun, H.,Zhang, Y.,Yang, J.. 2016. Diastereomer- and enantiomer-specific accumulation, depuration, bioisomerization, and metabolism of hexabromocyclododecanes (HBCDs) in two ecologically different species of earthworms. Science of the Total Environment 542:427-434					
Data Type:	Chronic (>21 days); Terrestrial; Invertebrate					
Hero ID:	3350510					
Domain		Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance						
	Metric 1:	Test Substance Identity	Medium	× 2	4	The percentage of each isomer was not mentioned, only the source and previous work has characterized the percentage of each isomer.
	Metric 2:	Test Substance Source	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 3:	Test Substance Purity	High	× 1	1	See note ‘***’ at the bottom of the table.
Domain 2: Test Design						
	Metric 4:	Negative Controls	Medium	× 2	4	Uncertainty regarding the control clean sediment, specifically if the same carrier solvent used in the HBCD treatments was used in the clean soil used for the control.
	Metric 5:	Negative Control Response	Unacceptable		4	biological responses were not reported
	Metric 6:	Randomized Allocation	Low	× 1	3	Allocation method not reported
Domain 3: Exposure Characterization						
	Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	Medium	× 1	2	Only one exposure concentration per HBCD isomer was used, but the purpose of the study is to evaluate HBCD uptake and depuration. However different numbers of each type of earthworm were used.
	Metric 12:	Testing at or Below Solubility Limit	N/A		N/A	soil exposure
Domain 4: Test Organism						
	Metric 13:	Test Organism Characteristics	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ‘***’ at the bottom of the table.
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Study Citation:	Li, B.,Yao, T.,Sun, H.,Zhang, Y.,Yang, J.. 2016. Diastereomer- and enantiomer-specific accumulation, depuration, bioisomerization, and metabolism of hexabromocyclododecanes (HBCDs) in two ecologically different species of earthworms. Science of the Total Environment 542:427-434				
Data Type:	Chronic (>21 days); Terrestrial; Invertebrate				
Hero ID:	3350510				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
	Metric 15: Number of Organisms and Replicates per Group	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 16: Adequacy of Test Conditions	High	× 1	1	See note ‘***’ at the bottom of the table.
Domain 5: Outcome Assessment					
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ‘***’ at the bottom of the table.
Domain 6: Confounding / Variable Control					
	Metric 19: Confounding Variables in Test Design and Procedures	Medium	× 2	4	No explanation for different number of organisms used.
	Metric 20: Outcomes Unrelated to Exposure	Medium	× 1	2	no data on health outcomes were reported
Domain 7: Data Presentation and Analysis					
	Metric 21: Statistical Methods	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 22: Reporting of Data	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ‘***’ at the bottom of the table.
Overall Quality Determination [‡]		Unacceptable → Low		4.0	Although biological responses weren’t reported for the earthworms, nor was it reported whether a solvent was used in the negative control, this study doesn’t necessarily mean it didn’t capture it. The goal of the study wasn’t to look at toxicity necessarily, but uptake and depuration.
Extracted		Yes			
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Study Citation:	Li, B.,Yao, T.,Sun, H.,Zhang, Y.,Yang, J.. 2016. Diastereomer- and enantiomer-specific accumulation, depuration, bioisomerization, and metabolism of hexabromocyclododecanes (HBCDs) in two ecologically different species of earthworms. Science of the Total Environment 542:427-434
Data Type:	Chronic (>21 days); Terrestrial; Invertebrate
Hero ID:	3350510

Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
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* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases}$$

where High= ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 40: Data Evaluation table for reference 3350537 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/3350537).

Study Citation:	Du, M.,Fang, C.,Qiu, L.,Dong, S.,Zhang, X.,Yan, C.. 2015. Diastereoisomer-specific effects of hexabromocyclododecanes on hepatic aryl hydrocarbon receptors and cytochrome P450s in zebrafish (Danio rerio). Chemosphere 132:24-31					
Data Type:	Chronic (>21 days); Aquatic; Fish					
Hero ID:	3350537					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 5: Outcome Assessment						
Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
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Study Citation:	Du, M.,Fang, C.,Qiu, L.,Dong, S.,Zhang, X.,Yan, C.. 2015. Diastereoisomer-specific effects of hexabromocyclododecanes on hepatic aryl hydrocarbon receptors and cytochrome P450s in zebrafish (Danio rerio). Chemosphere 132:24-31					
Data Type:	Chronic (>21 days); Aquatic; Fish					
Hero ID:	3350537					
Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}	
Domain 6: Confounding / Variable Control						
Metric 19:	Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 20:	Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
Metric 21:	Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 22:	Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 23:	Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.0		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High= ≥ 1 to < 1.7 ; Medium= ≥ 1.7 to < 2.4 ; Low= ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{***} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 41: Data Evaluation table for reference 3546057 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/3546057).

Study Citation:	Shi, D.,Lv, D.,Liu, W.,Shen, R.,Li, D.,Hong, H.. 2017. Accumulation and developmental toxicity of hexabromocyclododecanes (HBCDs) on the marine copepod Tigriopus japonicus. Chemosphere 167:155-162					
Data Type:	Other; Aquatic; Invertebrates					
Hero ID:	3546057					
Domain		Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance						
	Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 3: Exposure Characterization						
	Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 12:	Testing at or Below Solubility Limit	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 4: Test Organism						
	Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 5: Outcome Assessment						
	Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.
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Study Citation:	Shi, D.,Lv, D.,Liu, W.,Shen, R.,Li, D.,Hong, H.. 2017. Accumulation and developmental toxicity of hexabromocyclododecanes (HBCDs) on the marine copepod Tigriopus japonicus. Chemosphere 167:155-162					
Data Type:	Other; Aquatic; Invertebrates					
Hero ID:	3546057					
Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}	
Domain 6: Confounding / Variable Control						
Metric 19:	Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 20:	Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
Metric 21:	Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 22:	Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 23:	Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.0		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High= ≥ 1 to < 1.7 ; Medium= ≥ 1.7 to < 2.4 ; Low= ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{***} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 42: Data Evaluation table for reference 3586421 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/3586421).

Study Citation:	Ltd, W. I. 1997. Hexabromocyclododecane (HBCD): A 48-Hour Flow-Through Acute Toxicity Test with the Cladoceran (Daphnia magna) with Cover Letter Dated 06/20/1997.					
Data Type:	Acute (0-96 hour); Aquatic; Invertebrates					
Hero ID:	3586421					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 3:	Test Substance Purity	Medium	× 1	2	Unsure of what the impurities are among the three samples that were submitted. The HBCD used in the experiment is a composite of samples from three different manufacturers:.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	Medium	× 1	2	The selection of HBCD exposure concentrations higher than the water solubility is explained (solubility enhanced by the use of carrier solvent), but the test parameters were explained so that it is likely that the exposure concentrations were consistent throughout the experiment and the test organisms were healthy in all the control treatments.	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
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Study Citation:	Ltd, W. I.. 1997. Hexabromocyclododecane (HBCD): A 48-Hour Flow-Through Acute Toxicity Test with the Cladoceran (Daphnia magna) with Cover Letter Dated 06/20/1997.					
Data Type:	Acute (0-96 hour); Aquatic; Invertebrates					
Hero ID:	3586421					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
	Metric 15: Number of Organisms and Replicates per Group	Medium	× 1	2	Only two reps per treatment group.	
	Metric 16: Adequacy of Test Conditions	High	× 1	1	See note '***' at the bottom of the table.	
Domain 5: Outcome Assessment						
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note '***' at the bottom of the table.	
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note '***' at the bottom of the table.	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	Medium	× 2	4	Study reported minor differences among the treatment groups in regards to HBCD concentrations.	
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note '***' at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	Low	× 1	3	No statistical methods were outlined.	
	Metric 22: Reporting of Data	High	× 2	2	See note '***' at the bottom of the table.	
	Metric 23: Explanation of Unexpected Outcomes	Medium	× 1	2	The death in one treatment group was not explained, but was reported, and the differences in HBCD concentrations in a few of the treatment groups were explained.	
Overall Quality Determination [‡]		High		1.3		
Extracted		Yes				
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Study Citation: Ltd, W. I.. 1997. Hexabromocyclododecane (HBCD): A 48-Hour Flow-Through Acute Toxicity Test with the Cladoceran (*Daphnia magna*) with Cover Letter Dated 06/20/1997.
 Data Type: Acute (0-96 hour); Aquatic; Invertebrates
 Hero ID: 3586421

Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}
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* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High= ≥ 1 to < 1.7 ; Medium= ≥ 1.7 to < 2.4 ; Low= ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 43: Data Evaluation table for reference 3586422 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/3586422).

Study Citation:	Ltd, W. I. 1997. Letter from Chem Mfgs Assoc to USEPA Regarding: Toxicological Investigation of Hexabromocyclododecane (HBCD) with Attachments, Dated 06/27/1997.					
Data Type:	Acute (0-96 hour); Aquatic; Fish					
Hero ID:	3586422					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 3:	Test Substance Purity	Medium	× 1	2	Unsure of what the impurities are in the HBCD exposure.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	Medium	× 1	2	Some concentrations were above HBCD's water solubility, but all exposure concentrations were measured.	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	Medium	× 1	2	Only two true replicates per treatment group.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 5: Outcome Assessment						
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Study Citation:	Ltd, W. I.. 1997. Letter from Chem Mfgs Assoc to USEPA Regarding: Toxicological Investigation of Hexabromocyclododecane (HBCD) with Attachments, Dated 06/27/1997.				
Data Type:	Acute (0-96 hour); Aquatic; Fish				
Hero ID:	3586422				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note '***' at the bottom of the table.
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note '***' at the bottom of the table.
Domain 6: Confounding / Variable Control					
	Metric 19: Confounding Variables in Test Design and Procedures	Medium	× 2	4	Some uncertainty with the HBCD concentrations in the exposure treatment groups. Mentioning of co-eluting artifacts.
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note '***' at the bottom of the table.
Domain 7: Data Presentation and Analysis					
	Metric 21: Statistical Methods	Low	× 1	3	Statistical methods are unclear.
	Metric 22: Reporting of Data	High	× 2	2	See note '***' at the bottom of the table.
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note '***' at the bottom of the table.
Overall Quality Determination [‡]		High		1.2	
Extracted		Yes			

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 44: Data Evaluation table for reference 3586422 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/3586422).

Study Citation:	Ltd, W. I.. 1997. Letter from Chem Mfgs Assoc to USEPA Regarding: Toxicological Investigation of Hexabromocyclododecane (HBCD) with Attachments, Dated 06/27/1997.				
Data Type:	Acute (0-96 hour); Aquatic; Plants				
Hero ID:	3586422				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance					
Metric 1:	Test Substance Identity	High	× 2	2	See note '***' at the bottom of the table.
Metric 2:	Test Substance Source	High	× 1	1	See note '***' at the bottom of the table.
Metric 3:	Test Substance Purity	Medium	× 1	2	Uncertainty with impurities present .
Domain 2: Test Design					
Metric 4:	Negative Controls	High	× 2	2	See note '***' at the bottom of the table.
Metric 5:	Negative Control Response	High	× 1	1	See note '***' at the bottom of the table.
Metric 6:	Randomized Allocation	High	× 1	1	See note '***' at the bottom of the table.
Domain 3: Exposure Characterization					
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note '***' at the bottom of the table.
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note '***' at the bottom of the table.
Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note '***' at the bottom of the table.
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note '***' at the bottom of the table.
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note '***' at the bottom of the table.
Metric 12:	Testing at or Below Solubility Limit	Medium	× 1	2	Some exposure concentrations are above water solubility limits.
Domain 4: Test Organism					
Metric 13:	Test Organism Characteristics	High	× 2	2	See note '***' at the bottom of the table.
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note '***' at the bottom of the table.
Metric 15:	Number of Organisms and Replicates per Group	Low	× 1	3	Uncertainty with number of replicates used per exposure concentration.
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note '***' at the bottom of the table.
Domain 5: Outcome Assessment					
Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note '***' at the bottom of the table.
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Study Citation:	Ltd, W. I.. 1997. Letter from Chem Mfgs Assoc to USEPA Regarding: Toxicological Investigation of Hexabromocyclododecane (HBCD) with Attachments, Dated 06/27/1997.				
Data Type:	Acute (0-96 hour); Aquatic; Plants				
Hero ID:	3586422				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 6: Confounding / Variable Control					
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 7: Data Presentation and Analysis					
	Metric 21: Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 22: Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.
Overall Quality Determination [‡]		High		1.1	
Extracted		Yes			

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases}$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 45: Data Evaluation table for reference 3586425 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/3586425).

Study Citation:	Reindl, K. M.,Kittilson, J. D.,Bergan, H. E.,Sheridan, M. A.. 2011. Growth hormone-stimulated insulin-like growth factor-1 expression in rainbow trout (<i>Oncorhynchus mykiss</i>) hepatocytes is mediated by ERK, PI3K-AKT, and JAK-STAT. 301:R236-R243					
Data Type:	Acute (0-96 hour); Aquatic; Fish					
Hero ID:	3586425					
Domain		Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance						
	Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 3: Exposure Characterization						
	Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 9:	Measurement of Test Substance Concentration	Medium	× 1	2	nominal in vitro cell exposure
	Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 12:	Testing at or Below Solubility Limit	Medium	× 1	2	nominal in vitro cell exposure
Domain 4: Test Organism						
	Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 5: Outcome Assessment						
	Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.
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Study Citation:	Reindl, K. M., Kittilson, J. D., Bergan, H. E., Sheridan, M. A.. 2011. Growth hormone-stimulated insulin-like growth factor-1 expression in rainbow trout (<i>Oncorhynchus mykiss</i>) hepatocytes is mediated by ERK, PI3K-AKT, and JAK-STAT. 301:R236-R243					
Data Type:	Acute (0-96 hour); Aquatic; Fish					
Hero ID:	3586425					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 6: Confounding / Variable Control						
Metric 19:	Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 20:	Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
Metric 21:	Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 22:	Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 23:	Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.1		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 46: Data Evaluation table for reference 3586533 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/3586533).

Study Citation:	Ltd, W. I.. 1998. Initial Submission: Hexabromocyclododecane (HBCD) - A Flow-Through Life-Cycle Toxicity Test with the Cladoceran (<i>Daphnia magna</i>), Final Report, with Cover Letter Dated 5/18/1998.				
Data Type:	Chronic (>21 days); Aquatic; Invertebrates				
Hero ID:	3586533				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance					
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.
Metric 3:	Test Substance Purity	Medium	× 1	2	Unsure of what the impurities are in the HBCD mixture used in exposures.
Domain 2: Test Design					
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.
Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.
Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 3: Exposure Characterization					
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.
Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ^{***} at the bottom of the table.
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.
Metric 12:	Testing at or Below Solubility Limit	Medium	× 1	2	There are exposure concentrations above the water solubility of HBCD.
Domain 4: Test Organism					
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.
Metric 15:	Number of Organisms and Replicates per Group	Medium	× 1	2	Only two replicates per treatment group.
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 5: Outcome Assessment					
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Study Citation:	Ltd, W. I.. 1998. Initial Submission: Hexabromocyclododecane (HBCD) - A Flow-Through Life-Cycle Toxicity Test with the Cladoceran (<i>Daphnia magna</i>), Final Report, with Cover Letter Dated 5/18/1998.					
Data Type:	Chronic (>21 days); Aquatic; Invertebrates					
Hero ID:	3586533					
Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}	
	Metric 17: Outcome Assessment Methodology	High	× 2	2	See note '***' at the bottom of the table.	
	Metric 18: Consistency of Outcome Assessment	High	× 1	1	See note '***' at the bottom of the table.	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note '***' at the bottom of the table.	
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note '***' at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	High	× 1	1	See note '***' at the bottom of the table.	
	Metric 22: Reporting of Data	High	× 2	2	See note '***' at the bottom of the table.	
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note '***' at the bottom of the table.	
Overall Quality Determination [‡]		High		1.1		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

****** Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. **(a)** High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. **(b)** Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. **(c)** Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. **(d)** Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. **(e)** Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 47: Data Evaluation table for reference 3586733 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/3586733).

Study Citation:	Corp, U. C.. 1990. The Acute Toxicity of HBCD Lot 990-17 to the Bluegill Sunfish <i>Lepomis macrochirus rafinesque</i> with Test Data and Cover Letter.					
Data Type:	Acute (0-96 hour); Aquatic; Fish					
Hero ID:	3586733					
Domain		Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance						
	Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 3: Exposure Characterization						
	Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 9:	Measurement of Test Substance Concentration	Low	× 1	3	nominal
	Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 12:	Testing at or Below Solubility Limit	Low	× 1	3	nominal, precipitate present
Domain 4: Test Organism						
	Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 5: Outcome Assessment						
	Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.
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Study Citation:	Corp, U. C.. 1990. The Acute Toxicity of HBCD Lot 990-17 to the Bluegill Sunfish <i>Lepomis macrochirus rafinesque</i> with Test Data and Cover Letter.					
Data Type:	Acute (0-96 hour); Aquatic; Fish					
Hero ID:	3586733					
Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}	
Domain 6: Confounding / Variable Control						
Metric 19:	Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 20:	Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
Metric 21:	Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 22:	Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 23:	Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.2		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{***} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 48: Data Evaluation table for reference 3618094 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/3618094).

Study Citation:	Lower, N.. 2008. The Effects of Contaminants on Various Life-Cycle Stages of Atlantic Salmon (<i>Salmo salar</i> L.).					
Data Type:	Chronic (>21 days); Aquatic; Fish					
Hero ID:	3618094					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
	Metric 1:	Test Substance Identity	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 2:	Test Substance Source	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 3:	Test Substance Purity	High	× 1	1	See note ‘***’ at the bottom of the table.
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 5:	Negative Control Response	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 6:	Randomized Allocation	High	× 1	1	See note ‘***’ at the bottom of the table.
Domain 3: Exposure Characterization						
	Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 12:	Testing at or Below Solubility Limit	High	× 1	1	See note ‘***’ at the bottom of the table.
Domain 4: Test Organism						
	Metric 13:	Test Organism Characteristics	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ‘***’ at the bottom of the table.
	Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ‘***’ at the bottom of the table.
Domain 5: Outcome Assessment						
	Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ‘***’ at the bottom of the table.
	Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ‘***’ at the bottom of the table.
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Study Citation:	Lower, N.. 2008. The Effects of Contaminants on Various Life-Cycle Stages of Atlantic Salmon (<i>Salmo salar</i> L.).				
Data Type:	Chronic (>21 days); Aquatic; Fish				
Hero ID:	3618094				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 6: Confounding / Variable Control					
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 20: Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 7: Data Presentation and Analysis					
	Metric 21: Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 22: Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.
Overall Quality Determination [‡]		High		1.0	
Extracted		Yes			

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{***} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 49: Data Evaluation table for reference 3619397 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/3619397).

Study Citation:	Schriks, M.. 2006. Novel In Vitro, Ex Vivo and In Vivo Assays Elucidating the Effects of Endocrine Disrupting Compounds (EDCs) on Thyroid Hormone Action.					
Data Type:	Other; Aquatic; other frog					
Hero ID:	3619397					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	Low	× 1	3	nominal conc	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	Low	× 1	3	not addressed; nominal conc	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	Medium	× 1	2	Number of organisms reported but not replicates	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 5: Outcome Assessment						
Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
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Study Citation:	Schriks, M.. 2006. Novel In Vitro, Ex Vivo and In Vivo Assays Elucidating the Effects of Endocrine Disrupting Compounds (EDCs) on Thyroid Hormone Action.					
Data Type:	Other; Aquatic; other frog					
Hero ID:	3619397					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 6: Confounding / Variable Control						
Metric 19:	Confounding Variables in Test Design and Procedures	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 20:	Outcomes Unrelated to Exposure	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 7: Data Presentation and Analysis						
Metric 21:	Statistical Methods	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 22:	Reporting of Data	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 23:	Explanation of Unexpected Outcomes	High	× 1	1	See note ^{***} at the bottom of the table.	
Overall Quality Determination [‡]		High		1.2		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 50: Data Evaluation table for reference 3809143 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/3809143).

Study Citation:	M. Oetken, K. Ludwichowski, R. Nagel. 2001. Validation of the preliminary EU-concept of assessing the impact of chemicals to organisms in sediment by using selected substances.					
Data Type:	Chronic (>21 days); Aquatic; Sediment-dwelling					
Hero ID:	3809143					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
	Metric 1:	Test Substance Identity	High	× 2	2	
	Metric 2:	Test Substance Source	Low	× 1	3	not reported
	Metric 3:	Test Substance Purity	Low	× 1	3	not reported
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	× 2	2	
	Metric 5:	Negative Control Response	High	× 1	1	
	Metric 6:	Randomized Allocation	High	× 1	1	
Domain 3: Exposure Characterization						
	Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	
	Metric 8:	Consistency of Exposure Administration	High	× 1	1	
	Metric 9:	Measurement of Test Substance Concentration	High	× 1	1	
	Metric 10:	Exposure Duration and Frequency	High	× 2	2	
	Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	
	Metric 12:	Testing at or Below Solubility Limit		N/A	sediment exposure	
Domain 4: Test Organism						
	Metric 13:	Test Organism Characteristics	High	× 2	2	
	Metric 14:	Acclimitization and Pretreatment Conditions	Low	× 1	3	not reported
	Metric 15:	Number of Organisms and Replicates per Group	Low	× 1	3	Number of replicates per concentration was not reported
	Metric 16:	Adequacy of Test Conditions	High	× 1	1	
Domain 5: Outcome Assessment						
	Metric 17:	Outcome Assessment Methodology	High	× 2	2	
	Metric 18:	Consistency of Outcome Assessment	High	× 1	1	
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Study Citation:	M. Oetken, K. Ludwichowski, R. Nagel. 2001. Validation of the preliminary EU-concept of assessing the impact of chemicals to organisms in sediment by using selected substances.					
Data Type:	Chronic (>21 days); Aquatic; Sediment-dwelling					
Hero ID:	3809143					
Domain	Metric	Rating [†]	MWF [*]	Score	Comments ^{††}	
Domain 6: Confounding / Variable Control						
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2		
	Metric 20: Outcomes Unrelated to Exposure	Low	× 1	3	not reported	
Domain 7: Data Presentation and Analysis						
	Metric 21: Statistical Methods	High	× 1	1		
	Metric 22: Reporting of Data	High	× 2	2		
	Metric 23: Explanation of Unexpected Outcomes	Medium	× 1	2	Unexpected outcomes such as control organisms taking longer to emerge than organisms exposed to HBCD were not explained.	
Overall Quality Determination [‡]		High		1.4		
Extracted		Yes				

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \frac{\sum_i (\text{Metric Score}_i \times \text{MWF}_i)}{\sum_j \text{MWF}_j} \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases}$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{**} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 51: Data Evaluation table for reference 4269889 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4269889).

Study Citation:	ACC. 2003. Hexabromocyclododecane (HBCD): A Prolonged Sediment Toxicity Test with <i>Hyalella azteca</i> Using Spiked Sediment with 2 percent Total Organic Carbon.					
Data Type:	Chronic (>21 days); Aquatic; Sediment-dwelling					
Hero ID:	4269889					
Domain		Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 1: Test Substance						
	Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 3: Exposure Characterization						
	Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 9:	Measurement of Test Substance Concentration	Medium	× 1	2	only the control, lowest and highest exposure concentrations were measured
	Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 12:	Testing at or Below Solubility Limit	N/A		N/A	sediment exposure
Domain 4: Test Organism						
	Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.
	Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.
Domain 5: Outcome Assessment						
	Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.
	Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.
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Study Citation:	ACC. 2003. Hexabromocyclododecane (HBCD): A Prolonged Sediment Toxicity Test with Hyalella azteca Using Spiked Sediment with 2 percent Total Organic Carbon.				
Data Type:	Chronic (>21 days); Aquatic; Sediment-dwelling				
Hero ID:	4269889				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 6: Confounding / Variable Control					
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note '***' at the bottom of the table.
	Metric 20: Outcomes Unrelated to Exposure	Medium	× 1	2	not reported
Domain 7: Data Presentation and Analysis					
	Metric 21: Statistical Methods	High	× 1	1	See note '***' at the bottom of the table.
	Metric 22: Reporting of Data	High	× 2	2	See note '***' at the bottom of the table.
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note '***' at the bottom of the table.
Overall Quality Determination [‡]		High		1.1	
Extracted		Yes			

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{***} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].

Table 52: Data Evaluation table for reference 4269912 (https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4269912).

Study Citation:	ACC. 2003. Hexabromocyclododecane (HBCD): A Prolonged Sediment Toxicity Test with Hyalella azteca Using Spiked Sediment with 5 percent Total Organic Carbon.					
Data Type:	Chronic (>21 days); Aquatic; Sediment-dwelling					
Hero ID:	4269912					
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}	
Domain 1: Test Substance						
Metric 1:	Test Substance Identity	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 2:	Test Substance Source	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 3:	Test Substance Purity	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 2: Test Design						
Metric 4:	Negative Controls	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 5:	Negative Control Response	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 6:	Randomized Allocation	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 3: Exposure Characterization						
Metric 7:	Experimental System/Test Media Preparation	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 8:	Consistency of Exposure Administration	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 9:	Measurement of Test Substance Concentration	Medium	× 1	2	only the control, lowest and highest exposure concentration was measured	
Metric 10:	Exposure Duration and Frequency	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 11:	Number of Exposure Groups/Spacing of Exposure Levels	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 12:	Testing at or Below Solubility Limit	N/A		N/A	sediment exposure	
Domain 4: Test Organism						
Metric 13:	Test Organism Characteristics	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 14:	Acclimitization and Pretreatment Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 15:	Number of Organisms and Replicates per Group	High	× 1	1	See note ^{***} at the bottom of the table.	
Metric 16:	Adequacy of Test Conditions	High	× 1	1	See note ^{***} at the bottom of the table.	
Domain 5: Outcome Assessment						
Metric 17:	Outcome Assessment Methodology	High	× 2	2	See note ^{***} at the bottom of the table.	
Metric 18:	Consistency of Outcome Assessment	High	× 1	1	See note ^{***} at the bottom of the table.	
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Study Citation:	ACC. 2003. Hexabromocyclododecane (HBCD): A Prolonged Sediment Toxicity Test with Hyalella azteca Using Spiked Sediment with 5 percent Total Organic Carbon.				
Data Type:	Chronic (>21 days); Aquatic; Sediment-dwelling				
Hero ID:	4269912				
Domain	Metric	Rating [†]	MWF*	Score	Comments ^{††}
Domain 6: Confounding / Variable Control					
	Metric 19: Confounding Variables in Test Design and Procedures	High	× 2	2	See note '***' at the bottom of the table.
	Metric 20: Outcomes Unrelated to Exposure	Medium	× 1	2	not reported
Domain 7: Data Presentation and Analysis					
	Metric 21: Statistical Methods	High	× 1	1	See note '***' at the bottom of the table.
	Metric 22: Reporting of Data	High	× 2	2	See note '***' at the bottom of the table.
	Metric 23: Explanation of Unexpected Outcomes	High	× 1	1	See note '***' at the bottom of the table.
Overall Quality Determination [‡]		High		1.1	
Extracted		Yes			

* MWF = Metric Weighting Factor

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

$$\text{Overall rating} = \begin{cases} 4 & \text{if any metric is Unacceptable} \\ \left\lfloor \sum_i (\text{Metric Score}_i \times \text{MWF}_i) / \sum_j \text{MWF}_j \right\rfloor_{0.1} & \text{(round to the nearest tenth) otherwise} \end{cases},$$

where High = ≥ 1 to < 1.7 ; Medium = ≥ 1.7 to < 2.4 ; Low = ≥ 2.4 to < 3 . If the reviewer determines that the overall rating needs adjustment, the original rating is crossed out and an arrow points to the new rating.

^{††} Reviewers document uncertainties and strengths for each metric, when deemed necessary.

^{***} Note: This metric met the criteria for medium or high confidence rating as described in Appendix F of the Application of Systematic Review for TSCA Risk Evaluations document. EPA acknowledges that there are instances where the characteristics of the study does not fully fulfill the criteria of the particular metrics. EPA plans to default to the definitions of the confidence levels and corresponding scores at the metric level (see below) when the criteria language is not currently optimized to capture a variety of study characteristics. EPA is in the process of identifying these issues to optimize the evaluation tool. (a) High: No notable deficiencies or concerns are identified in the domain metric that are likely to influence the results [score of 1]. (b) Medium: Minor uncertainties or limitations are noted in the domain metric that are unlikely to have a substantial impact on the results [score of 2]. (c) Low: Deficiencies or concerns are noted in the domain metric that are likely to have a substantial impact on the results [score of 3]. (d) Unacceptable: Serious flaws are noted in the domain metric that consequently make the data/information source unusable. [score of 4]. (e) Not rated/applicable: Rating of this metric is not applicable to the data/information source being evaluated [no score].